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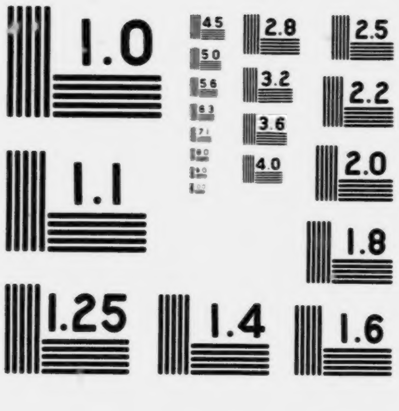
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DEVELOPMENT AND TRAIL OF A BASIC COURSE IN MUSIC THEORY USING SELF- INSTRUCTIONAL MATERIALS TO SUPPLEMENT TRAINING RECEIVED IN HIGH SCHOOL PERFORMANCE GROUPS. FINAL REPORT.
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DESCRIPTORS- *PROGRAMED INSTRUCTION, TESTS OF SIGNIFICANCE, *ACADEMIC ACHIEVEMENT, *MUSIC THEORY, *MUSIC EDUCATION, GROUPS, EXPERIMENTS, QUESTIONNAIRES, PROGRAMED MATERIALS,

IN AN EXPERIMENT TO TEST EFFECTS OF A PROGRAMED TEXT AND RECORDS IN MUSIC INSTRUCTION, A PRE-TEST ON WRITTEN THEORY AND AURAL RESPONSE GIVEN TO 957 STUDENTS IN NINE SCHOOLS IN AN EXPERIMENTAL AND A MATCHED CONTROL GROUP SHOWED SIGNIFICANT DIFFERENCES FOR THOSE WITH PREVIOUS PRIVATE MUSIC STUDY AND HIGHER GRADE POINT AVERAGES, BUT NO DIFFERENCES ON TEST SCORES AND GRADE LEVEL. ON THE SAME TEST GIVEN AFTER THE EIGHT-MONTH COURSE, THE EXPERIMENTAL GROUP SHOWED SIGNIFICANT IMPROVEMENT OVER THE CONTROL GROUP IN COMPARISON OF PRE- AND POST-TEST SCORES, ALTHOUGH BOTH GROUPS, CONSIDERED SEPARATELY, IMPROVED SIGNIFICANTLY, AND ALL POST-TEST SCORES WERE SIGNIFICANTLY HIGHER THAN ALL PRE-TEST SCORES. ACHIEVEMENT WAS NOT RELATED TO GRADE LEVEL, AND THOSE IN THE EXPERIMENTAL GROUP WITH PREVIOUS PRIVATE LESSONS ACHIEVED SIGNIFICANTLY MORE (A RELATIONSHIP POSSIBLY EXPLAINED BY GENERAL INTEREST IN MUSIC). ALL NINE TEACHERS RESPONDED FAVORABLY TO THE MATERIALS, BUT THEY CRITICIZED (ON A QUESTIONNAIRE) THE OCCASIONAL DIFFICULTY AND VOLUME OF THE MATERIAL. STUDENT ATTITUDES WERE GENERALLY NEGATIVE, ACCORDING TO THE TEACHERS. (LH)

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FINAL REPORT

Project No. H-285

Contract No. OE-6-10-087

DEVELOPMENT AND TRIAL OF A BASIC COURSE IN MUSIC THEORY USING SELF-INSTRUCTIONAL MATERIALS TO SUPPLEMENT TRAINING RECEIVED IN HIGH SCHOOL PERFORMANCE GROUPS

July 1967

U. S. DEPARTMENT OF
HEALTH, EDUCATON, AND WELFARE

Office of Education
Bureau of Research

DEVELOPMENT AND TRIAL OF A BASIC COURSE IN MUSIC THEORY USING SELF-INSTRUCTIONAL MATERIALS TO SUPPLEMENT TRAINING RECEIVED IN HIGH SCHOOL PERFORMANCE GROUPS

Project No. H-285
Contract No. OE-6-10-087

Dr. J. Austin Andrews

July 31, 1967

The research reported herein was performed pursuant to a contract with the Office of Education, U. S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

Eastern Washington State College

Cheney, Washington

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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CHAPTER 1

INTRODUCTION

The idea of developing and trying a course in basic music theory for high school use, particularly by members of performing groups, has not, to the knowledge of the author, been the basis of any other study or research. The materials developed are unusual, if not unique, in several ways:

1. The materials are developed for use at the secondary school level. Certain college textbooks do contain a statement by their authors that the books are also suitable for high school, but they are written primarily for the college theory class.

2. The material is almost entirely self-instructional, so little time need be taken from rehearsal. The traditional theory courses take a great deal of teacher time.

3. The materials include written music theory combined with recorded ear training, the record containing music recorded by various orchestral instruments.

4. The teacher's manual gives specific suggestions for class activities.

Most textbooks are made available with little or no trial in the field. The field study will show whether or not these materials will accomplish the desired objectives, and what additions, deletions, and changes would improve their effectiveness.

The theory of music is one of the aspects of musical understanding upon which directors of high school performance groups are being asked to place more emphasis. Recent meetings of music educators have stressed the idea of enriching the offerings to the performing groups. The 1966 "MENC Convention Reports" mention that demonstrations incorporating music literature, history and theory into the rehearsal were given. Conclusions drawn in the Senior High School session at that convention include:

> "(a) Wider horizons than performance alone are necessary to achieve a greater understanding of music and the arts. (b) Materials designed for teaching in this manner are relatively unavailable." (8)

Similar demonstrations of incorporating music theory and other phases of music into the rehearsal were given during the Northwest Conference of Music Educators National Conference held in Spokane, Washington in 1965.

The National Conference to Improve the Effectiveness of State Supervision of Music suggests as one area needing further study "...to locate ways to bring about more functional learning of theoretical, historical, and other musical aspects in choral and instrumental groups." (13)

High school music directors have been criticized in recent years for developing programs with emphasis almost entirely on performance, to the neglect of teaching general musical understanding and musicianship. As Leonhard and House say, "Many teachers proceed on the assumption that applied music instruction and performance groups should be limited to developing skills of performance and that musical knowledge and understanding are gained exclusively in general music class, theory classes, and so on. ...While each type of activity properly has its own focus, all teachers should be concerned with the over-all musical learning of their pupils." (12)

Others who have expressed similar opinions concerning the necessity for enrichment of the music program at the secondary level are: Block (4), Hartshorn (10), Hoffer (11), Nye (14), Porter (15), and Tait (17).

The low level of accomplishment outside of performance shown by freshmen music majors in colleges and universities is one of the indications for a reappraisal and enrichment of school music. (9), (12) This has been found true at Eastern Washington State College where a placement examination in music theory has been given to all entering music majors for several years. The main deficiencies seem to be in the areas of ear training and rhythmic response, although a large proportion of the students tested lack a basic knowledge of rhythmic and pitch notation which would seem fundamental to their performance.

In order to have a theory book that students could study at home, it was decided to prepare a programmed textbook. The idea of programming music fundamentals is not a new one, as there are many such books available, none of which, however, seemed adequate for this particular project. A list of programmed books in music fundamentals and music theory currently available is found in Appendix A.

Research has shown that programmed music theory materials are an effective teaching tool. Studies showing that programmed instruction compares favorably with conventional methods of teaching are shown by: Andrews and Wardian (1), Ashford (2), Barnes (3), Carlsen (5), Cribb (6), Dallin (7), Spohn (16), and Wardian (18).

A programmed textbook based on the first quarter of music theory at Eastern Washington State College, but placing more emphasis on basic melodic and rhythmic notation and musical terms, was prepared and tested in a pilot study during the school year 1965-66. To include ear training, examples for listening and dictation were recorded. These materials were prepared with the idea that the presentation should proceed by small enough steps that the student could study by himself outside of class time. A teacher's manual giving specific suggestions for class activities to supplement the programmed textbook without taking much rehearsal time was also prepared.

The musical objectives of the course for the high school students are:

1. The development of an understanding of melodic notation, including such concepts as clefs, tonality, major and minor modes, and intervals.

2. The development of an understanding of rhythmic notation, including such concepts as meter, pulse, duration of tones, and rhythmic patterns.

3. The development of an understanding of terms to indicate tempo and dynamics.

4. The development of an understanding of the rules of simple harmonic progressions.

5. The development of the ability to hear, remember, and symbolize in notation simple melodic, rhythmic and harmonic patterns.

6. The development of the ability to hear mentally and perform simple melodic rhythmic and harmonic patterns which the student sees symbolized in notation.

The main focus of the study was to determine whether or not students in performing groups using the prepared materials develop competencies in music theory to a significantly greater extent than students who receive only the usual instruction without supplementary materials during the experimental period.

The following null hypotheses were developed regarding the pilot study:

1. There is no significant difference between pretest and posttest scores.

2. There is no significant relationship between the achievements measured of students taking the pretest and posttest.

3. There is no significant relationship between the total time spent in study and the number of frames missed.

4. There is no significant relationship between the amount of knowledge gained as assessed by a pretest and posttest and the amount of time spent in study.

5. There is no significant relationship between the amount of knowledge gained as assessed by a pretest and posttest and the number of frames missed.

The following null hypotheses were developed regarding the pretest:

1. There is no significant difference between the scores of experimental and control groups on the pretest.

2. There is no significant relationship between the scores on the pretest and the grade level of the students.

3. There is no significant difference between scores of males and females.

4. There is no significant relationship between the scores on the pretest and the academic achievement of students as measured by the grade point average in all subjects which the students have taken.

5. There is no significant difference between scores on the pretest of students having taken 2 years or more of private music study and students not having had 2 years of private music study.

6. There is no significant difference between scores on the pretest of students having studied keyboard instruments and students having studied an orchestral instrument or voice.

7. There is no significant difference between the grade point average of students who have had 2 or more years of private lessons and students who have not had 2 years of private lessons.

The following null hypotheses were developed regarding the comparison of the pretest and posttest:

1. There is no significant difference between the experimental and control groups in amount of improvement in scores of the posttest over the pretest.

2. There is no significant difference between pretest and posttest scores for all students taking these tests.

3. There is no significant difference between pretest and posttest scores for students in the control group.

4. There is no significant difference between pretest and posttest scores for students in the experimental group.

5. There is no significant relationship between the amount of achievement made as assessed by pretest and posttest and grade levels of students in the control group.

6. There is no significant relationship between the amount of achievement made as assessed by pretest and posttest and grade levels of students in the experimental group.

7. There is no significant difference between amount of achievement made as assessed by pretest and posttest by students having taken 2 or more years of private music study and students not having had 2 years of private music study in the control group.

8. There is no significant difference between amount of achievement made as assessed by pretest and posttest by students having taken 2 or more years of private music study and students not having had 2 years of private music study in the experimental group.

9. There is no significant difference between males and females in the amount of achievement made as assessed by pretest and posttest in the control group.

10. There is no significant difference between males and females in the amount of achievement made as assessed by pretest and posttest in the experimental group.

11. There is no significant relationship between amount of achievement made as assessed by pretest and posttest and academic achievement by students in the control group.

12. There is no significant relationship between amount of achievement made as assessed by pretest and posttest and academic achievement by students in the experimental group.

13. There is no significant relationship between amount of achievement made as assessed by a pretest and posttest and the percentage of frames missed in the programmed text by the experimental group.

The following objectives were developed regarding the teacher survey:

1. To obtain an evaluation of the prepared materials by teachers who have used them for a school year.

2. To determine how much student achievement was influenced by amount and kind of class help.

3. To determine reaction to materials by students in experimental group.

4. To determine whether or not teachers of control group emphasized music fundamentals and theory more than usual.

5. To determine whether or not there was an observable change in students in control group.

The experiment with high school students was made in 9 selected secondary schools during the 1966-67 school year. At the beginning of the experimental study there were 482 students in the experimental classes which were to use the programmed materials and 475 students in the control classes.

CHAPTER 2

METHOD OF CARRYING ON THE PROJECT

The method of carrying on the project can be divided into the following steps:

1. Preparation in summary form of the content to be in the experimental high school music theory course.
2. Programming of the text and the recording of the musical examples and dictation.
3. Pilot study of the programmed text and recordings with a small group of college students.
4. The revision of the materials in light of the results of the pilot study.
5. The preparation, trial, and revision of the test to be used as a pretest and posttest in the field study.
6. The preparation of a teacher's guide.
7. The selection and matching of the experimental and control groups in secondary schools for the field test.
8. The administration of the pretest and preparation of data concerning the results of this test.
9. The checking of answer sheets as they are submitted from the various experimental classes.
10. Visitation of the experimental groups in order to ascertain progress and difficulties.
11. Administration of a mid-course test to determine progress being made.
12. Administration of the posttest to experimental and control groups and preparation of data concerning the results of this test.
13. Questionnaire to teachers concerning criticisms and suggestions regarding the course.

1. Preparation of the course content. It was decided that the high school theory course would contain the approximate

equivalent of a first quarter college theory course, but that more emphasis would be placed upon the fundamentals of rhythmic and melodic notation. A summary of the following materials was prepared:

Meter
Rhythm
Tempo
Note recognition (treble and bass clefs)
Intervals
Scales
Key signatures
Major and minor scales
Modes
Musical terms: tempo and dynamic
Triads
Chord progressions
Harmonization of melodies
Timbre of the various orchestral instruments

2. Programming of the text and preparation of the recording. The material which had been summarized was prepared in the form of a programmed textbook. A linear method of programming was used in which an active response was required for each of the frames, the student either to write his response or to refer to the recording for listening or dictation. It was found that the amount of material to be programmed required a few more than 1000 frames with the material arranged in small steps. The recording for the pilot study was done with piano on magnetic tape with several copies prepared so that students taking part in the pilot study could have access to the recorded material.

3. Pilot study of the materials. During the spring of 1966 a pilot study was made using the prepared materials. A detailed report of the problems, hypotheses tested, procedures used, and the results of the pilot study are contained in the first part of Chapter 3.

4. Revision of programmed text and recording. All of the frames missed by three or more of the experimental class in the pilot study were revised. In doing this, much of the material was put into easier steps and some of the more advanced material near the end of the book was moved to an appendix. A summary of the text by lessons and frames is found in Appendix B.

All of the musical examples which had been recorded on tape were re-recorded using various orchestral instruments plus piano. The reason for using orchestral instruments was to help the students taking the course become aware of the timbre of the various orchestral instruments. The recordings were first made with professional equipment on tape and then transferred to 5 long playing recordings by a commercial recording company. Examples were performed by members of the music staff at Eastern Washington State College.

Sufficient copies of the programmed textbook, answer pad, and recordings were made so that each student in the experimental group could have his own personal copy for the field test during the school year 1966-67.

5. Preparation and trial of test. A multiple choice test was prepared so that it could be machine graded. The test, as devised, is in 2 sections. Part A is entirely written theory containing questions on rhythmic and pitch notation, key signatures, scales, intervals, chords, musical terms and harmony. Part B of the test measures the ability to relate musical sounds to notation. This part of the test has questions relating to melodies, intervals, chords, and progressions. The music was played on piano and tape recorded. A summary of the test content is found in Table 2.1.

TABLE 2.1

SUMMARY OF THEORY TEST CONTENT

Part A - Written Theory	No. of Questions
Notation	8
Pitch	
Rhythmic	
Key signatures	7
Scales	3
Intervals	6
Chords	8
Terms (tempo and dynamic)	6
Harmony (4-part)	12
	50

Part B - Aural Response	No. of Questions
Melodic dictation	10
Interval dictation	20
Chord dictation	20
Chordal progressions	10
	60

A sampling of undergraduate students at Eastern Washington State College was given the test as a pilot project. These students had a variety of musical backgrounds; some of them were taking a music fundamentals course, some were taking the third quarter of music theory, some had taken music theory as long as 3 years previously.

An item analysis was run in order to check for discriminatability. Four items were found to be negatively discriminating. These items were modified to correct for negative discrimination. The item analysis also revealed broad categories of difficult, medium, and easy items which are described in Table 2.2.

TABLE 2.2

ITEM ANALYSIS OF MUSIC THEORY TEST

	Easy Items	Medium Difficulty Items	Difficult Items
Part A	14	22	14
Part B	13	29	18

Data on the pilot trial of the theory test are shown in Table 2.3.

TABLE 2.3

PILOT TRIAL OF THEORY TEST

	n	Mean	S. D.
Part A 50 Questions	64	32.921	9.124
Part B 60 Questions	59	33.711	11.98

Additional statistics revealed a correlation coefficient between Test A and Test B of .653. This is highly significant beyond the .01 level of confidence, indicating a high degree of relationship between the 2 tests. The students taking the test retained their same relative class standing. Applying the coefficient of determination it was found that 43% of the variability in one of the test sections can be accounted for in the other.

6. Preparation of the teacher's guide. A teacher's guide was written containing the following materials:

1. An introduction in which was placed a list of materials, the contents of the course, objectives, and anticipated results.

2. A section containing directions for getting the course started.

3. For each week of the 30 week course: an assignment for students, topics included in the week's assignment, a summary of the material in the students' books, and suggested activities for classroom use.

7. The selection and matching of secondary school groups. Schools invited to participate in the field study were selected so that there would be a variety of sizes and types of schools. The very small schools invited to participate did not respond so there were no quite small schools included in the study. There are, however, schools of medium and large size from different types of communities. Appendix C consists of a chart showing the size of each school, the percentage of students taking music, the size and organization of the experimental and control group, the type of school, and comments about the school.

It was hoped to have about 1000 students in the experiment, 500 in the control group and 500 in the experimental group; however, because there were students who were absent on one or both days in which the pretest was administered, and also because the sizes of the groups were not exactly the same as indicated by the various directors, the final figures of those taking the pretest are 475 in the control group and 482 in the experimental group.

These 957 students were randomly divided into control and experimental groups depending upon the wishes of the directors concerned. A comparison of the pretest scores made by the control and experimental groups showed that they were well matched with the control group being slightly superior. The results of the pretest are in Chapter 3.

8. Administration of pretest and preparation of data concerning the results. The test described in 5 above was administered to all students in the control and experimental

groups. The results of this test are given in the second part of Chapter 3.

9. Checking of answer sheets. As students were directed not to erase incorrect answers but simply to cross them out and correct the answer, it was not a difficult job to check these answer sheets for each lesson as they were forwarded to the project office by each school music director. The reasons for checking the answer sheets were to determine the percentage of errors made by each student and to find places in which students were having trouble. Directors of high school groups were notified if many students seemed to be having trouble with a particular part of the text so that this might be stressed in a class discussion if the director wished.

10. Visitation of experimental groups. All experimental groups were visited regularly by the Project Director or the Assistant Project Director to discuss the progress of the students with the school music director and also to receive comments from students as to problems or questions which they might have. It was also found that regular visits were necessary because some of the school directors failed to mail in the answer sheets as requested.

11. Administration of mid-course test. It was found that many of the directors were not giving the periodic tests as suggested in the teacher's manual so a decision was made to visit all of the schools at the time that the mid-course test should be given and administer it. Results of that mid-course test are found in Appendix D.

The mid-course test revealed the fact that many students were either copying answers in the programmed text, or for other reasons were not assimilating the material. Those on the project checking answer sheets had also decided that certain students were probably copying answers instead of actually thinking through the material as presented. A decision was made by the Project Director and Assistant Project Director to ask those students who answered less than 25% of the questions correctly to start the course over to try to understand better the first part of the course before proceeding to the second part. The high school directors agreed that this was an idea that was pedagogically sound. It was realized that this group of students would probably not finish the course.

12. Administration of posttest. The same test that was used for the pretest was again used for the posttest. All students who had taken the pretest and who were still in the control and experimental groups were given the posttest administered by the

Project Director. Results of the posttest are found in the third part of Chapter 3.

13. Questionnaire to teachers. At the time that the students were taking the posttest, teachers of the experimental and control groups were asked to fill in a brief questionnaire. The results of these questionnaires will be found in the last part of Chapter 3.

CHAPTER 3

RESULTS

The various results obtained in the study are divided into 4 categories:

1. The Pilot Study
2. The Pretest
3. The Posttest Compared With The Pretest
4. The Teacher Questionnaire

The results obtained in each of these categories will be discussed separately.

RESULTS OF PILOT STUDY

In the pilot study the following problems were presented:

1. To determine whether students can successfully complete a course in basic music theory using programmed materials and recordings plus a minimum amount of class time.

2. To determine whether the students can cover the materials in the time allotted. The testers wanted to know if the average student could complete the course in approximately 30 hours -- an hour per week during the following year's field trial.

3. To determine which frames and sections of the first draft of the material needed revision because of the error rate and misunderstandings.

Hypotheses Tested

1. There is no significant difference between pretest and posttest scores.

2. There is no significant relationship between the achievements measured of students taking the pretest and posttest.

3. There is no significant relationship between the total time spent in study and the number of frames missed.

4. There is no significant relationship between the amount of knowledge gained as assessed by a pretest and posttest and the amount of time spent in study.

5. There is no significant relationship between the amount of knowledge gained as assessed by a pretest and posttest and the number of frames missed.

Procedures

1. A group of 12 volunteers was secured from a class in music fundamentals for classroom teachers to take the course. The only prerequisite was previous membership in a high school performing group. The group which volunteered was slightly below the average of college students in cumulative grade point average in all college courses previously taken. The median grade point average was 2.10, the mean grade point was 1.96. (these figures are based on a 4-point scale: A=4, B=3, C=2, D=1.)

2. The experimental group was given a pretest of material contained in the programmed basic music theory course.

3. The selected students were given the programmed textbook and tapes of recorded materials were made available in the library. A weekly minimum assignment was made to be sure the students would complete the materials by the end of the quarter.

4. The class met twelve 50 minute periods during the quarter, including the periods for the pretest and posttest. During these sessions, except for those in which the testing was done, questions were answered and help was given by the instructor.

5. The students were requested to record the time at which they started and stopped in each day's study, showing not only the total time spent, but which sections of the material are more time-consuming.

6. A posttest (the same as the pretest) was given to determine the amount learned.

Method of Analysis

Hypothesis 1 was tested by means of the t test. Hypotheses 2, 3, 4, and 5 were tested by means of the Pearson product-moment correlation coefficient.

Results

Hypothesis 1. There is no significant difference between pretest and posttest scores, is rejected. A t of 5.87 was computed. This is significant beyond the .01 level of confidence, indicating that the posttest scores were significantly higher.

Hypothesis 2. There is no significant relationship between the achievement measured of students taking the pretest and posttest, is rejected. A correlation of .878 was computed. This is significant beyond the .01 level of confidence, showing that students who scored high on the pretest also scored high on the posttest.

Hypothesis 3. There is no significant relationship between the total time spent in study and the number of frames missed, is accepted. A correlation of .456 was computed. This is not significant at the .05 level of confidence. Those who studied more did not miss a significantly larger number of frames.

Hypothesis 4. There is no significant relationship between the amount of knowledge gained as assessed by a pretest and posttest and the amount of time spent in studying, is accepted. A negative correlation of -.437 was computed. This is not significant at the .05 level of confidence. Those who studied more did not make significantly lower scores.

Hypothesis 5. There is no significant relationship between the amount of knowledge gained as assessed by a pretest and posttest and the number of frames missed, is accepted. A correlation of .514 was computed. This is not significant at the .05 level of confidence, indicating that those who missed the most frames did not achieve significantly higher scores.

Measurements obtained by analyzing the data of the pilot study are contained in Table 3.1.

TABLE 3.1

TABLE OF MEASUREMENTS OBTAINED IN ANALYZING THE DATA OF A PILOT STUDY IN ACHIEVEMENT IN MUSIC THEORY

Variables	Number	Mean	Median	S. D.
Pretest	12	12.9	11	8.34
Posttest	12	52.3	51.5	9.63
Difference scores between pretest and posttest	12	38.7	39.5	4.22
Time in hours	11*	30.9	25.5	10.7
Programmed instruction Frames missed (number out of 1,000)	11*	51.1	43	32.8

* One student did not complete the text.

A discussion of the results of the pilot study is in Chapter 4.

RESULTS OF PRETEST

The test described in Chapter 2, page 9 was given to the 957 students in the experimental and control groups in September, 1966.

Hypotheses Tested

1. There is no significant difference between the scores of experimental and control groups on the pretest.

2. There is no significant relationship between the scores on the pretest and the grade level of the students.

3. There is no significant difference between scores of males and females.

4. There is no significant relationship between the scores on the pretest and the academic achievement of students as measured by the grade point average in all subjects which the students had taken.

5. There is no significant difference between scores on the pretest of students having taken 2 years or more of private music study and students not having had 2 years of private music study.

6. There is no significant difference between scores on the pretest of students having studied keyboard instruments and students having studied an orchestral instrument or voice.

7. There is no significant difference between the grade point average of students who have had 2 or more years of private lessons and students who have not had 2 years of private lessons.

Methods of Analysis

Hypotheses 1, 3, 5, 6, and 7 were tested by means of the *t* test. Hypothesis 2 was tested by means of chi square. Hypothesis 4 was tested by means of the Pearson product-moment correlation coefficient.

Results

Hypothesis 1. Statistical comparison of the experimental and control groups as assessed by a pretest showed no significant difference in the 2 groups, although the control group showed slight superiority. On Test A a *t* of .3267 was computed; on Test B a *t* of 1.083 was computed; on the combined tests a *t* of .7643 was computed. None are significant at the .05 level of confidence, so hypothesis 1 is accepted. Results of the pretest are shown in Table 3.2. (Appendix E contains pretest statistics on the schools.)

TABLE 3.2

COMPARISON OF CONTROL AND EXPERIMENTAL GROUPS HIGH SCHOOL MUSIC THEORY PRETEST SCORES

	Range	Median	Mean	S. D.	*t*
TEST A (50 questions)					
Control (n=475)	2-41	13.00	14.12	6.58	.3267
Experimental (n=482)	1-47	13.00	13.98	6.93	
TEST B (60 questions)					
Control (n=475)	6-46	21.00	21.92	7.50	1.083
Experimental (n=482)	7-52	20.50	21.38	7.80	
COMBINED A & B (110 questions)					
Control (n=475)	11-82	34.00	36.09	12.70	.7643
Experimental (n=482)	11-94	32.50	35.45	13.24	

Hypothesis 2. A comparison of the scores and grade level revealed a chi square of 11.956 on Part A of the test and a chi square of 22.279 on Part B. Neither is significant at the .05 level of confidence. Hypothesis 2 is accepted for both parts of the test. Scores for all students tested are not significantly higher in the upper grades.

As a corollary to hypothesis 2, the scores of the instrumental groups were compared with grade level. This computation showed a chi square of 35.000 (highly significant beyond the .01 level of confidence) on Part A of the test and a chi square of 19.13 (not significant at the .05 level of confidence) on Part B. Hypothesis 2, therefore, is rejected for instrumental performance groups, only, on Part A of the test. In instrumental ensembles scores are significantly higher in the upper grades on Part A of the test but not on Part B of the test.

Hypothesis 3. The difference between male and female students' test scores was not significant (t= -.654) for Part A but was significant beyond the .01 level of confidence (t= -4.456) for Part B. Hypothesis 3, therefore, is accepted for Part A but rejected for Part B, the females showing higher scores than the males on Part B of the test.

Hypothesis 4. The relationship between scores made on this test and general academic record as measured by the cumulative grade point average was highly significant. In Part A the correlation was r= .484 and in Part B, the correlation was r= .433, with both correlations highly significant beyond the .01 level of confidence. Hypothesis 4 is rejected for both Parts A and B of the test. There is a definite relationship between grade point average and scores, the students with higher grade point averages making higher scores.

Hypothesis 5. The difference between scores made for students with private study for 2 or more years and students with no private study or less than 2 years private study was highly significant. In Part A a t of 10.546 was computed and in Part B a t of 10.617 was computed. Both of these are significant beyond the .01 level of confidence. Hypothesis 5 is rejected. Those studying music privately made higher scores on the pretest.

Hypothesis 6. Computation of the difference between scores made by those whose private study was on a keyboard instrument and those who studied an orchestral instrument or voice showed a t of 2.659 for Part A and a t of 4.916 for Test B. Both are highly significant beyond the .01 level of confidence. Those who studied a keyboard instrument made significantly higher scores. Hypothesis 6 is rejected.

Hypothesis 7. A t of 7.77 was computed in the difference in grade point average of students with and without private instruction. This is a significant difference indicating that the students who have taken 2 or more years or private music lessons do have a significantly higher grade point average. Hypothesis 7 is rejected.

A comparison of the experimental and control groups as to grade point average, the taking of private music lessons, and sex is presented in Table 3.3 on page 21.

TABLE 3.3

COMPARISON OF CONTROL AND EXPERIMENTAL GROUPS
BY GPA, PRIVATE MUSIC LESSONS, AND SEX

	Academic record*		Private music lessons for 2 or more years	Percent of females
	Mean	Median		
Control	2.65	2.65	41%	59%
Experimental	2.49	2.50	38%	57%

* Based on Grade Point Average in all subjects taken. (1=D, 2=C, 3=B, 4=A)

RESULTS OF THE POSTTEST COMPARED WITH RESULTS OF THE PRETEST

The test which was given as a pretest was given as a posttest in May, 1967. The results of the posttest by schools is in Appendix F.

Hypotheses Tested

1. There is no significant difference between the experimental and control groups in amount of improvement in scores of the posttest over the pretest.

2. There is no significant difference between pretest and posttest scores for all students taking these tests.

3. There is no significant difference between pretest and posttest scores for students in the control group.

4. There is no significant difference between pretest and posttest scores for students in the experimental group.

5. There is no significant relationship between the amount of achievement made as assessed by pretest and posttest and grade levels of students in the control group.

6. There is no significant relationship between the amount of achievement made as assessed by pretest and posttest and grade levels of the students in the experimental group.

7. There is no significant difference between the amount of achievement made as assessed by pretest and posttest by students having taken 2 or more years of private music study and students not having had 2 years of music study in the control group.

8. There is no significant difference between amount of achievement made as assessed by pretest and posttest by students having taken 2 or more years of private music study and students not having had 2 years of music study in the experimental group.

9. There is no significant difference between males and females in the amount of achievement made as assessed by pretest and posttest in the control group.

10. There is no significant difference between males and females in the amount of achievement made as assessed by pretest and posttest in the experimental group.

11. There is no significant relationship between amount of achievement made as assessed by pretest and posttest and academic achievement by students in the control group.

12. There is no significant relationship between amount of achievement made as assessed by pretest and posttest and academic achievement by students in the experimental group.

13. There is no significant relationship between amount of achievement made as assessed by a pretest and posttest and the percentage of frames missed in the programmed text.

Methods of Analysis

Hypotheses 1, 7, 8, 9, and 10 were tested by means of the *t* test for independent samples. Hypotheses 2, 3, and 4 were tested by means of the *t* test for paired observations. Hypotheses 5 and 6 were tested by means of chi square. Hypotheses 11, 12, and 13 were tested by means of the Pearson product-moment correlation coefficient.

Results

Hypothesis 1. In computing the difference between the experimental and control groups in amount of improvement in scores of the posttest over the pretest, a *t* of 10.599 was computed for Test A, a *t* of 3.134 was computed for Test B, and a *t* of 9.179 was computed for the combined Test A and B. All of these are highly significant beyond the .01 level of confidence. The improvement in scores made by the experimental group was significantly more than the improvement made by students in the control group. Hypothesis 1 is rejected. Statistics showing this difference between control and experimental groups in improvement in scores are shown in Table 3.4. The difference between pretest and posttest scores by schools is in Appendix G.

TABLE 3.4

DIFFERENCE BETWEEN CONTROL AND EXPERIMENTAL GROUPS IN IMPROVEMENT IN SCORES FROM THE PRETEST TO THE POSTTEST

	All Control Group (n=355)		All Experimental Group (n=390)
TEST A			
Mean	1.96		6.23
t		10.599**	
TEST B			
Mean	.79		2.09
t		3.134**	
COMBINED TESTS			
Mean	2.73		8.35
t		9.179**	

**Significant at .01 level of confidence

As a corollary to hypothesis 1 the control and experimental groups were divided into the upper 25%, the middle 50%, and the lower 25% to compute further statistics. The results of these computations are shown in Table 3.5. Further statistics on the control and experimental groups when divided into upper, middle and lower group scores are found in Appendix H.

TABLE 3.5

DIFFERENCE BETWEEN CONTROL AND EXPERIMENTAL GROUPS IN IMPROVEMENT IN SCORES FROM THE PRETEST TO THE POSTTEST WHEN COMPARING UPPER, MIDDLE, AND LOWER SCORES

	Upper 25%		Middle 50%		Lower 25%	
	Control (n=88)	Exp. (n=97)	Control (n=179)	Exp. (n=195)	Control (n=88)	Exp. (n=98)
TEST A						
Mean	4.48	11.48	2.17	6.16	-.966	1.17
t	7.845**		8.801**		4.092**	
TEST B						
Mean	3.93	5.96	1.07	1.99	-2.87	-1.58
t	2.511*		1.824		1.769	
COMBINED A & B						
Mean	6.59	15.71	3.16	8.23	-1.99	1.18
t	7.578**		6.857**		3.385**	

* Significant at .05 level of confidence
**Significant at .01 level of confidence

Since over half the students in the experimental group did not complete the entire text which contained 30 lessons, as a second corollary to Hypothesis 1, computations were made to show the difference between the control group and those in the experimental group who had completed a specified number of lessons. The results of these computations are shown in Table 3.6. Further statistics on the experimental group when divided according to lessons completed are found in Appendix I.

TABLE 3.6

DIFFERENCE BETWEEN CONTROL GROUP AND THOSE IN EXPERIMENTAL GROUP WHO HAVE COMPLETED A SPECIFIC NUMBER OF LESSONS

	Control (n=355)	Exp. 25-30 Lessons (n=120)	Exp. 20-24 Lessons (n=65)	Exp. 15-19 Lessons (n=108)	Exp. 0-14 Lessons (n=96)
TEST A					
Mean	1.96	7.95	6.95	5.07	4.92
t		9.010**	7.959**	4.590**	4.855**
TEST B					
Mean	.79	2.65	2.32	1.53	1.88
t		2.994**	2.089*	1.256	1.581
COMBINED A & B					
Mean	2.73	10.78	9.23	6.51	6.80
t		7.952**	6.311**	4.065**	4.315**

* Significant at .05 level of confidence
**Significant at .01 level of confidence

Hypothesis 2. Computation of the difference between pretest and posttest scores for all students showed a significant improvement from the pretest to the posttest. A t of 15.736 was computed for Test A. A t of 6.831 was computed for Test B. A t of 14.707 was computed for the combined Test A and B. All of these are highly significant beyond the .01 level of confidence, so hypothesis 2 is rejected.

Hypothesis 3. For students in the control group, computation of the difference between the pretest and the posttest scores gave a t of 7.146 on Test A, a t of 2.626 on Test B, and a t of 6.372 on the combined Test A and B. All of these are highly significant beyond the .01 level of confidence, with the posttest scores much higher than the pretest scores. Hypothesis 3 is, therefore, rejected.

Hypothesis 4. Computing the difference between the pretest and posttest scores for students in the experimental group showed a t of 14.024 on Test A, a t of 6.806 on Test B, and a t of 13.348 on the combined Test A and B. All of these are highly significant beyond the .01 level of confidence, showing that the posttest scores are much higher than the pretest scores. Hypothesis 4 is, therfore, rejected.

Table 3.7 shows the difference between pretest and posttest scores for all students, for the control group, and for the experimental group.

TABLE 3.7

DIFFERENCE BETWEEN PRETEST AND POSTTEST SCORES

	Premean	Postmean	t
ALL STUDENTS (n=745)°			
Test A	14.53	18.72	15.736**
Test B	22.11	23.59	6.832**
Combined A & B	36.66	42.33	14.707**
CONTROL GROUP (n=355)°			
Test A	14.70	16.66	7.146**
Test B	22.31	23.10	2.626**
Combined A & B	37.05	39.78	6.372**
EXPERIMENTAL GROUP (n=390)°			
Test A	14.36	20.60	14.024**
Test B	21.93	24.03	6.806**
Combined A & B	36.30	44.65	13.348**

°The number in each group has changed from the original pretest because students changed schedules, advanced to more select performance groups, dropped out of class, dropped out of school, or were absent when posttests were administered.

**Significant at .01 level of confidence

Hypothesis 5. Computation of the chi square (Test A, χ^2=20.473; Test B, χ^2=18.389; Combined Test A & B, χ^2=20.744) showed that there is no significant relationship between the amount of achievement made as assessed by pretest and posttest and the grade level of students in the control group. The students in the upper grades did not achieve significantly more than students in the lower grades. Hypothesis 5 is accepted.

Hypothesis 6. Computation of the chi square (Test A, χ^2=19.243; Test B, χ^2=18.260; Combined Test A & B, χ^2=12.014) showed that there is no significant relationship between the amount of achievement made as assessed by pretest and posttest and grade level of students in the experimental group. Students in the upper grades did not achieve significantly more than the students in the lower grades. Hypothesis 6 is also accepted. Figures showing the chi square relationships are in Table 3.8.

TABLE 3.8

RELATIONSHIP BETWEEN ACHIEVEMENT AND GRADE LEVELS

	Control Chi Square	Experimental Chi Square
Test A	20.473	19.243
Test B	18.389	18.260
Combined A & B	20.744	12.014

Hypothesis 7. Students in the control group who had taken 2 or more years of private study did not achieve significantly more in either of the tests than did the students who had not taken 2 years of private music study. For Test A the t was .7964, for Test B the t was 1.570, for the combined Test A & B the t was 1.675. Hypothesis 7 is accepted.

Hypothesis 8. There is a significant difference between the amount of achievement made by students in the experimental group who had taken 2 or more years of private music study as compared with students who had not taken 2 years of music study. (Test A, *t*=2.37; Test B, *t*=2.642; combined Test A & B *t*=3.435) Those who had taken private lessons achieved significantly more. Hypothesis 8, therefore, is rejected. Table 3.9 shows the difference in achievement between those with private music study for 2 or more years and those without private music study for 2 years.

TABLE 3.9

DIFFERENCE IN ACHIEVEMENT BETWEEN
THOSE WITH PRIVATE MUSIC STUDY AND
THOSE WITHOUT PRIVATE MUSIC STUDY

	TEST A		TEST B		COMBINED A & B	
	mean	*t*	mean	*t*	mean	*t*
CONTROL GROUP						
With Lessons (n=156)	2.19	.7964	1.32	1.570	3.49	1.675
Without Lessons (n=199)	1.78		.38		2.14	
EXPERIMENTAL GROUP						
With Lessons (n=154)	7.15	2.370*	3.03	2.642**	10.31	3.435**
Without Lessons (n=236)	5.64		1.48		7.08	

* Significant at .05 level of confidence
**Significant at .01 level of confidence

Hypothesis 9. There is no significant difference between males and females in the amount of achievement made with the pretest and posttest in the control group. On Test A the *t* was 1.387; on Test B the *t* was -.577; on the combined Test A and B the *t* was .453. Hypothesis 9 is accepted.

Hypothesis 10. In the experimental group there is no significant difference between males and females in the amount of achievement made on Test A (t=1.580) nor on Test B (t=1.542); however, there is a significant difference with the females being higher on the combined test (t=2.126). Hypothesis 10 is accepted for Test A and Test B but rejected for the combined tests. Table 3.10 shows the difference in achievement by sex.

TABLE 3.10

DIFFERENCE IN ACHIEVEMENT BY SEX

	TEST A		TEST B		COMBINED A & B	
	mean	t	mean	t	mean	t
CONTROL GROUP						
Female (n=211)	2.26	1.387	.65	-.577	2.89	.453
Male (n=144)	1.53		1.00		2.51	
EXPERIMENTAL GROUP						
Female (n=229)	6.64	1.580	2.46	1.542	9.16	2.126*
Male (n=161)	5.65		1.57		7.21	

* Significant at .05 level of confidence

Hypothesis 11. Computation of the Pearson product-moment correlation coefficient shows no significant relationship between achievement in music theory and general academic achievement as assessed by the grade point average for the control group. (Test A, r=.060; Test B, r=.033; combined tests, r=.062) Hypothesis 11, therefore, is accepted.

Hypothesis 12. There is a significant relationship between the amount of achievement made on the theory test compared with the general academic achievement by students in the experimental group. The computations for Test A showed a relationship which is highly significant beyond the .01 level of confidence (r=.307). For Test B there was a relationship significant at the .05 level of confidence (r=.122). For the combined tests the relationship is significant beyond the .01 level of confidence (r=.281). Hypothesis 12, therefore, is rejected. Table 3.11 shows the relationship between achievement in music theory and academic achievement.

TABLE 3.11

RELATIONSHIP BETWEEN ACHIEVEMENT IN MUSIC THEORY AND ACADEMIC ACHIEVEMENT

	Control r	Experimental r
Test A	.060	.307**
Test B	.033	.122*
Combined A & B	.062	.281**

* Significant at .05 level of confidence
**Significant at .01 level of confidence

Hypothesis 13. Computation of the relationship between achievement in music theory and the percentage of frames missed in the programmed text show a nonsignificant negative correlation for Test A ($r = -.099$). A relationship significant at the .05 level of confidence for Test B ($r = -.131$) and a significant relationship for the combined tests ($r = -.152$). The negative correlation indicates that the students with higher scores made fewer errors in answering the questions in the programmed textbook. Hypothesis 13 is accepted for Test A but rejected for Test B and rejected for the combined tests.

RESULTS OF TEACHER QUESTIONNAIRE

In May, 1967 at the time that students were taking the posttest teachers were asked to fill in a questionnaire. A copy of this questionnaire is found in Appendix J.

The first question asked the average amount of class time spent weekly on the theory course. The answers varied from, "None," to "45 minutes per week."

Question 2 asked the teachers to rate their use of activities suggested for class use in the teacher's manual. The answers varied from "None" to "Used most suggestions." Most of the teachers, according to their answers, evidently did not use the teacher's manual extensively.

Question 3 asked the teachers to comment concerning the teacher's manual. Of the 9 teachers of experimental groups, 4 made no response to this question. The other 5 answers were favorable. Comments such as these were found on the questionnaire.

> "All things considered, the manual was very well arranged."
>
> "The manual was well organized."
>
> "I got mixed up between lesson numbers and page numbers."
>
> "The suggested activities were well adapted to the study material. The only fault lay in the amount of time necessary (daily) to make proper use of the manual."
>
> "I found it covered the areas of assignment quite well."
>
> "I thought it was a good manual. It could be used each day by the instructor who is not strong in the theory field and the results would be fine."

The fourth question asked the teachers to rate the reaction of the students to the theory course. The answers varied from "Disliked intensely" to "Liked." Comments concerning student reaction included the following:

> "Covered the whole range. Probably would have liked it much more if it had been less difficult toward the end."
>
> "The people who were extremely interested got a little bored with the repetition and didn't seem to feel at ease about skipping the sections they already know. The rest of the class worked under heavy duress."
>
> "The music students liked it. Those who were looking for an easy course did not like it. My top music people were thrilled with the course. The students with ability but little background became discouraged sometimes but came through with interest. Low students pressed the panic button."
>
> "The reaction was due to the fact that very few have any intention of pursuing music past their present stage. The amount of time involved in completing the lessons was quite great. This caused considerable frustration after they once found themselves behind."

"Some liked, some didn't."

"As the course began, it was liked very much. As it became harder many felt it was too hard and some dislike was shown."

Question 5 asked the teacher whether or not he planned to use the course again next year. Seven of the nine teachers answered "yes," one answered "No," and one was undecided.

Comments as to procedure for using the course next year are as follows:

DIRECTOR OF SCHOOL	
A	"For individuals and part of book in basic theory course."
B	"To be required of all choir members."
C	"For interested individuals only."
D	"Slower pace for most students while the interested ones move ahead."
E	"First part of course only."
F	"First part of course only."
G	"Will use in a theory course."
H	"Possibly in performing group but would prefer to use in a theory class."
J	"Use course for 9 weeks. Rest for 9 weeks. Review and use for another 9 weeks. Plan to cover material over a period of 3 years."

As a further indication of interest in the course, the teachers were asked whether or not they would purchase a book or text similar to this for use in their classes. Three of the teachers answered with an unqualified, "Yes." Two answered "No," giving as the reason, lack of funds. Two answered that they would have to examine the volume first to see what it contained and how it was arranged. On answered, "Not yet." One answered, "Possibly."

Question 7 was divided into 2 parts asking the teacher to comment on the course. The first part concerned content. These remarks were made:

> "Became quite difficult toward the end for the majority of students. Very well arranged and effective for those with more music background."
>
> "Too difficult in certain areas."
>
> "This seems to be for the interested music student."
>
> "Excellent but difficult for many."
>
> "Skips things."
>
> "Excellent but somewhat more comprehensive than I expected for high school use. It could be spread over 2 or 3 years and still have ample material to consume the time."
>
> "Good."
>
> "Good--standards were high."
>
> "Very good development of material. Tried to cover too much material in the time set up. More time must be spent in the listening area."

Answers concerning format were:

> "Good."
>
> "Records are a real problem."
>
> "OK."
>
> "Records hard to handle."
>
> "Satisfactory in most respects but it is bound to be a little expensive for high school use."
>
> "OK."
>
> "Book was all right. Records created problems as it was hard to find the place you needed."

A summary of answers to questions 1, 2, 4, 5, and 6 is found in Table 3.12.

TABLE 3.12

ANSWERS TO TEACHER QUESTIONNAIRE

SCHOOL	AVERAGE TIME IN MINUTES SPENT WEEKLY ON THEORY COURSE	USE OF TEACHER'S MANUAL	REACTION OF STUDENTS	PLAN TO USE AGAIN NEXT YEAR	WOULD YOU BUY A REVISED VERSION
A	15	very little	disliked	yes	no (funds)
B	0-15	some	varied-liked to disliked	yes	no (funds)
C	30	very little	disliked	yes	yes
D	60	used most suggestions	varied-liked to disliked	yes	yes
E	10	some	disliked (liked at first)	yes	not yet
F	0-15	very little	disliked	yes	must see first
G	0	none	disliked intensely	no	must see first
H	10	very little	varied-liked to disliked	undecided	possible
J	45	some	liked	yes	yes

The questionnaire for teachers of control groups asked 2 questions.

1. Did you consciously change your method of teaching music fundamentals and theory in the class this year from what you have normally done in previous years?

2. Was there any noticeable change in the attitude of the students because they realized they were to be compared with students receiving special materials?

All teachers of control groups answered, "No" to both questions.

CHAPTER 4

DISCUSSION OF RESULTS

The discussion of the results contained in Chapter 3 will be divided into the same 4 categories:

1. Discussion of the Pilot Study
2. Discussion of the Pretest
3. Discussion of the Posttest Compared with the Pretest
4. Discussion of the Teacher Questionnaire

PILOT STUDY

The results of the testing indicated that for the pilot group there was a significant gain in achievement between the pretest and posttest. This gives a favorable answer to the first problem, whether students can successfully complete a course in basic music theory using programmed materials and recordings plus a small amount of class time.

The mean amount of time spent by the students in the pilot study in completing the course was 30.9 hours. This gives a favorable answer to the second question, whether or not students are able to cover the materials in approximately 30 hours.

The error rate of about 5% of frames missed suggested that the text did not need extensive revision. However, it was found that there were certain frames which caused trouble because they were missed by 25% or more of the experimental group. These frames were revised. Many in the class also had difficulty with the advanced material near the end of the book so, in simplifying the first part of the book, some of the advanced material near the end of the book was moved to an appendix which the students would not be required to study as part of the course.

Each of the five hypotheses can be restated in terms of the results obtained.

Hypothesis 1. There was a highly significant difference between pretest and posttest scores.

Hypothesis 2. The gains in achievement were relative to the amount of knowledge originally possessed. As a group, students who did poorly on the first test also did poorly on the second and those who did well to begin with also made the most gains.

Hypothesis 3. Although there was a positive correlation between the total time spent in study and the number of frames missed, the nonsignificance of this correlation does not support a contention that the more time spent the more errors are made. However, more study of the relationship of these two variables is warranted. It is quite possible that this hypothesis is directly related to the second one in that those students who did well on the pretest would not need to spend as much time studying nor would they make as many errors.

Hypothesis 4. The nonsignificant negative correlation between the amount of knowledge gained and the amount of time spent in studying can be explained as above in No. 3.

Hypothesis 5. The positive correlation in the testing of the correlation between amount of knowledge gained and number of frames missed is nonsignificant. This particular correlation is related very closely to the explanations for the correlations in 3 and 4.

PRETEST

The test scores show that secondary school students in performance groups tested have been taught some music theory. As is expected in any subject, some students learn a great amount more than others, resulting in a wide range of scores. Those with the lowest scores probably guessed at the answers to most questions while those in the upper range revealed a very high achievement.

The experimental and control groups are well matched. The slight superiority of the control group was much better than if the experimental group had shown a superiority.

When all students were included, there was a lack of significant relationship between grade level and scores, which seemed to indicate a lack of progress in the theoretical aspects of music from grade to grade. However, the computation showing that the instrumental groups do progress from year to year in Test A emphasizes a basic difference between instrumental and choral groups. Since membership in a choral group does not appear to require the development of a skill to the extent that membership in an instrumental group does, the change of personnel from year to year is much greater in choral groups than instrumental groups. It is more difficult to build on the previous year's development in choral groups.

Scores on Test B, the ability to relate notation and musical sound, did not improve significantly from grade to grade even when the instrumental groups were computed separately.

The relatively higher achievement of females in the ability to relate notation of musical sound is interesting and perhaps should be the basis of further research.

The significant relationship between grade point average and test scores, between private study and test scores, and between grade point average and private study seems to lead to these conclusions. The students with high general academic achievement achieved high on this music theory test. The students who have had 2 or more years of private study also achieved high on this test. Since there is a quite significant relationship between the grade point average and private study it would seem that, at least in many cases, these were the same students. To determine which is the more influential factor, general academic achievement or private music lessons, further research is necessary.

The significantly greater achievement of those who had studied a keyboard instrument compared to those who studied an orchestral instrument or voice can be explained partly, at least, by the fact that keyboard study encompasses both treble and bass staffs, and enables the student to play and hear chords, chord progressions, and 4-part harmony.

COMPARISON OF POSTTEST AND PRETEST

Computations showed that there was a highly significant difference between the experimental and control groups in amount of improvement in scores on the posttest over the pretest, with the experimental group achieving much more than did the control group. This shows that the materials furnished to the experimental group were successful in helping students learn more music theory than ordinarily learned in performance groups.

In dividing the groups into upper 25%, middle 50%, and lower 25%, computations showed that in all 3 of the categories the experimental group exceeded the control group in scores by a highly significant margin on Test A. However, on Test B, the difference between the groups showed a significant gain of the experimental over the control only by the upper 25% of the groups. The ear training portion, then, is the more difficult part of the course for most students.

In dividing the experimental group by number of lessons completed (See Table 3.6 on page 25) computations showed that in all 4 categories the gains made by the experimental group were more by a highly significant margin than were the gains by the control group on Test A. However, on Test B, those students who had completed 25 lessons or more were the only ones who exceeded the gain made by the control group in a highly significant manner. While the group who had completed between 20 and 24 lessons did have a significantly higher achievement than the control group, those who had completed less than 20 lessons did not make a significantly greater achievement than did the control group.

When all students who took the pretest and posttest are combined, a significant improvement in scores between the 2 tests is shown.

The control group also showed significant improvement from pretest to posttest, indicating that students are being taught the theoretical aspects of music to some extent as part of the activities of the regular rehearsal. The teachers of the control group indicated on the teacher questionnaire that they did not teach more theory during the school year 1966-67 than usual, so theory is being incorporated into the rehearsal by some directors without the help of supplementary materials.

It was thought that perhaps the decrease in numbers after the statistics on the pretest were computed for both the control and experimental groups might have some influence on the amount of improvement shown, in that generally the poorer students would drop the class or drop out of school. A computation of the means on the pretest for the 355 in the control group who took the posttest shows slightly higher scores than those made by the original 475. However, these are not significant enough to materially effect the final computation. The pretest means for the original groups and for those who took the posttest are shown in Appendix K.

To be sure that the groups were still matched, a t test for independent samples was computed on the pretest scores to show the difference between the control and experimental groups who also took the posttest. On Test A there was a t of -.665, on Test B a t of -.660, and on the combined test there was a t of -.768. All of these are nonsignificant at the .05 level of confidence, showing that the control and experimental groups who took the posttest were matched on the pretest.

Not all schools in the control group did equally well on the improvement from pretest to posttest (See Appendix G). On Test A the difference between pretest and posttest scores was highly significant for 4 schools at the .01 level of confidence, significant for 2 schools at the .05 level of confidence, and not significant at the .05 level of confidence for 2 schools. On Test B only 1 school made highly significant improvement at .01 level of confidence, 1 school showed improvement at the .05 level of confidence, the other 6 schools showed improvement which was not significant at the .05 level of confidence.

There was also a highly significant improvement between the pretest and posttest scores for students in the experimental group. There was, however, a great deal of variability among the individual schools (See Appendix G). On Test A all schools made highly significant improvement. On Test B, however, only 4 schools made a highly significant improvement in scores.

It is interesting to note that of the 4 schools with a highly significant improvement on Test B, (schools B, C, D, and J) schools C, D, and J were the only 3 whose teachers indicated they spent 30 minutes or more each week on music theory in class. The same 3 schools are the ones whose directors indicated that they would be interested in purchasing a revised version of the text if one were available. The fourth school, B, indicated that the reason for not wanting to plan to purchase a revised version of the text was lack of funds.

Three out of 4 schools that improved the most on Test B (the ear training portion of the test) were the ones who spent at least 30 minutes weekly in class studying theory. This shows that, generally speaking, students had a great deal of difficulty in improving their ability to connect notation with hearing without teacher help. The recordings do not seem to be sufficient except for the most diligent of students.

The lack of a significant relationship between the amount of achievement in music theory as assessed by the pretest and posttest and the grade levels of the students in the experimental group indicates that it really does not make much difference at which level in school these materials are used. It should be pointed out, however, that the 1 junior high school involved in the study has a superior music program.

The lack of a significant relationship between achievement made from pretest to posttest and private lessons in the control group is a little difficult to reconcile with the pretest statistics in which there was a high correlation between scores and private music lessons. The disparity in figures here might be accounted for by the failure of the Project Director to ascertain how many of these students were taking private lessons at the time of the experimental theory course and how many had discontinued private lessons.

In contrast, students in the experimental group who had taken private lessons for 2 years or more achieved significantly more during the year of the field study than did those who had not taken private lessons for 2 years. One explanation is that those students who are more interested in music are more likely to be taking music lessons.

It has been stated that students who have difficulty in academic subjects may receive high grades in music. This particular statement does not hold true as far as the study of this course. The better students academically probably achieved more in this course because it involves the academic portion of music rather than performance. It is also necessary that a student be able to read well in order to study the course by himself. If he cannot read and understand, it is impossible for him to receive much value from self-instructional materials.

The negative correlation between scores and percentage of frames missed is probably brought about for a reason very similar to the one in the preceeding paragraph. The student who reads well would probably have very little difficulty in making the correct response to the questions in the frames; the student who does not read well would undoubtedly answer incorrectly because of his inability to read and understand.

TEACHER QUESTIONNAIRE

Some of the answers to the teacher questionnaire were discussed along with the statistics of the posttest in the previous section; however, further discussion seems appropriate for the parts that have not been discussed.

Although the reaction of the teachers was generally favorable to the prepared materials, the criticisms indicated that in the opinion of these teachers, the textbook was too difficult in places and contained too much material for high school students to complete in one year in addition to the other responsibilities which they have. Most of the experimental groups have heavy performance schedules which they maintained throughout the year in which the study was carried on, leaving very little time for the theory course.

The teacher's manual, while receiving favorable comment, was used very little by almost all directors. The principal reason given was lack of time during class periods. It should also be pointed out that all of the directors of experimental groups had been music majors while in college and were experienced teachers. An inexperienced director, particularly if he had not been a music major in college, would have to rely more on the manual.

The reaction of most students to the theory course as rated by their teachers is quite disappointing. According to the teachers, most of the students disliked the course. A question which was not included on the survey but was asked orally of each director when the student reaction was discovered was, "Did any of your students drop out of the performing group in order to escape the theory course?" Each teacher answered this in the negative. It seems that the dislike occurred more in the latter part of the book where the material becomes more difficult. Also students became tired of the week-after-week assignments for an entire school year. The dislike occurred mainly, of course, among those students who had difficulty completing the course for lack of ability or time. The situation would, in part, be alleviated by the following suggestions:

1. The text should be made less difficult and some of the more difficult material near the end of the book should be removed.

2. The course could be spread out over a period of 2 years so that students would not become so tired of the weekly assignments.

3. The teacher should take special care to see that the students are motivated. Students must be able to see some connection between the theory they are studying and the study of other phases of music, particularly performance.

CHAPTER 5

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

THE PILOT STUDY

The pilot study showed that:

1. Most students can complete the music theory course successfully in about 30 hours.

2. The material was presented in easy enough steps that it could be understood with very little teacher help.

The main weakness of the pilot study was that the group was made up of college students instead of high school students. What is true for college students is not necessarily true for high school students.

The pilot study for this project was conducted with a small group of selected college students because the project was planned as a 2 year study. In order to have time to prepare the materials, conduct the pilot study, and revise the materials in 1 year, it was necessary to complete the pilot study in 1 quarter. A pilot study under the actual conditions of the main field study using high school students in a performing group would, of necessity, have added another year to the project.

THE PRETEST

The tests and information gathered in the fall of 1966 showed that there was no significant difference between the control and experimental groups. The control group was slightly superior, however.

The lack of a significant relationship between grade level and the pretest scores leads to a conclusion that students in the secondary school performing groups tested do not, as a group, improve in the skills and knowledge tested from year to year. It would probably be presumptuous to assume that because this is true in 9 secondary schools in eastern and central Washington, that it is also true in secondary schools in all parts of the country. However, the opinions expressed by others as mentioned in Chapter 1 of this report suggest that it is a common problem.

It should be recognized, however, that many students are in choral groups for only 1 or 2 years. This fact, no doubt, had some influence on the lack of significant relationship between pretest scores and grade level.

When statistics were computed showing the relationship between scores and grade level of the instrumental groups only, a highly significant relationship was found for Test A. A nonsignificant relationship was computed for Test B. In instrumental groups, then, the students do improve significantly in the knowledge of that portion of music theory contained in Test A. (For the contents of Test A and Test B see Table 2.1 on page 9.)

It is interesting to note that the control group as a whole did improve significantly from pretest to posttest during the school year even though a large percentage of individual students did not improve. Also, of the 8 schools in the control group, 4 showed significant improvement during the year on the combined tests, while 3 did not show significant improvement and 1 school scored lower on the posttest than the pretest. (See Appendix G). This seems to indicate that if the skills and knowledge tested are important, more emphasis should be placed on music fundamentals, particularly in some schools, so there is more retention from year to year.

It was to be expected that there would be a significant relationship between the scores on the pretest and general academic achievment because music theory can be classed as an academic discipline.

The significantly higher scores on the pretest by those having had 2 or more years of private music study was also to be expected. The students studying with a private teacher are generally the ones more interested in music study. The statistics also serve as a compliment to the private music teachers in the area.

The superiority in test scores of those who had studied a keyboard instrument in private lessons when compared with those who had studied an orchestral instrument or voice attests to the fact that a knowledge of the keyboard is a definite asset to an understanding of music theory and harmony.

THE POSTTEST COMPARED WITH THE PRETEST

The main objective of the project was to determine whether or not the experimental group furnished with prepared materials in music theory would improve significantly more from pretest to posttest than would the control group which was taught by the teachers without help from supplementary materials. The fact that the experimental group improved significantly more than the control group from the pretest to the posttest shows quite definitely that supplementary materials will help the teacher of performance groups teach the skills and knowledge of music theory.

As a corollary to the improvement of the entire experimental group as compared to the entire control group, statistics were computed between the upper 25%, the middle 50%, and the lower 25% of these groups. In all 3 categories on Test A, the experimental group improvement exceeded that of the control group in a highly significant manner, showing that the material contained in Test A could be understood by all students at least to some extent. On Part B of the test, which correlated the textbook with the recordings, only the upper 25% of the experimental group did significantly better than did the upper 25% of the control group. The improvement was nonsignificant at the .05 level of confidence between the middle 50% of the groups and the lower 25% of the groups. These statistics show that only the upper portion of the students are able to use the recordings and gain significantly from them.

Another corollary of the difference between the experimental and control groups in the amount of improvement from pretest to posttest divided the experimental group into categories of number of lessons completed. On Test A, regardless of the number of lessons completed, the improvement of the experimental group was greater than the improvement of the control group by a highly significant margin. However, on Test B the improvement of only those students in the experimental group who completed 25 lessons or more was greater than the improvement of the control group by a highly significant margin (t= 2.99). Those in the experimental group who completed between 20 and 24 lessons showed a significant improvement over the control group (t= 2.08), but there was not as large a difference as the group who had completed more lessons. In the experimental group those who had completed less than 20 lessons did not improve significantly more than the control group (t= 1.25, t= 1.58). These statistics show that in order to learn much from the recordings, it is necessary that the students complete a large portion of the textbook.

Statistics showing that there is no significant relationship between the amount of achievement made as assessed by pretest and posttest and the grade level of students in the control and experimental groups indicates that those in the upper grades did not do appreciatively better with the course than did those in the lower grades. Although the materials were prepared with senior high school students in mind, these particular statistics show that even 7th and 8th graders can gain a great deal from the materials.

Students in the control group who had taken 2 years or more of private music study did not achieve a significantly greater amount than did students not having had 2 years of private music study. In the experimental group, however, those having had 2 or more years of private music study did achieve significantly more than those who had not had 2 years of private music study. These statistics show that if students who were interested enough to have taken private music lessons are given materials to study, they will make use of them.

There was very little difference between the achievement of males and females as shown by pretest and posttest scores.

There was a lack of significant relationship between achievement made as assessed by pretest and posttest scores and the cumulative grade point average earned in all subjects by students in the control group. A relationship between the amount of achievement made and grade point average was significant, however, for the experimental group, showing that if the students have materials to study, the better students, academically, will make use of those materials.

The statistics also seem to indicate that students who have made a low cumulative grade point average in all courses taken achieved little with this programmed music theory course. Some reasons for this are:

1. They have difficulty with all academic subjects.
2. They have not learned to study independent of direct teacher supervision.
3. They have difficulty reading and understanding the material.
4. They are members of the performance group to perform only, and are not interested in music theory.

The materials as used during the past year are certainly more effective with those students who are capable of a higher level of academic work.

The significant negative relationship between the amount of achievement and the percentage of frames missed again points out the fact that students who can read and understand can make better use of self-instructional materials.

In summarizing the results of the posttest scores, there are several indications that the materials are most effective when used with interested students who are capable of working on somewhat difficult materials by themselves with very little teacher help or supervision.

TEACHER QUESTIONNAIRE

An evaluation of the prepared materials by teachers who have used them for a school year combined with statistics found in the administration of the test and examination of answer sheets show the following:

1. The materials are too difficult for the average high school student, particularly the portion dealing with ear training in which the textbook is correlated with the recordings. If materials of this type are to be made available to students in other high schools, it would be advisable to revise the materials, simplifying them as much as possible.

2. There is too much material for students to cover in 1 school year and still maintain the heavy performance schedule which most groups have. Most teachers indicated that they planned to use the material in future years but to take more than 1 year to complete the prepared materials. It would also help to exclude the material near the end of the textbook.

3. The questionnaire showed that, generally speaking, those teachers who spent 30 minutes or more a week helping the students in the classes brought about better achievement, particularly in the more difficult material contained in the recordings. Generally it can be stated that any prepared materials cannot completely replace the teaching of a good teacher. The teacher who spends a little more time in class helping the students not only helps the students understand parts which may be somewhat difficult, but shows, by his willingness to give up rehearsal time, that he considers the course important. The attitude of the teacher no doubt influences the attitude of the students. Stated conversely, if the teacher is not willing to give time in class to a course of this nature, the students soon decide that the course is not important and not worth spending a great deal of time studying outside of class.

4. The above statements lead directly to the negative reaction on the part of most students to the materials. Students not only need some time in class for help with

> the course but need to realize that the course is important, or they will have a negative reaction to it. If students are to enjoy all phases of music, it is necessary that the teacher show that all phases of music are important. If music theory is of some importance to a rehearsal group, the teacher must show by his attitude that he considers this to be true.

The questionnaire submitted to the teachers of the control group showed that their groups were taught in a manner similar to the way they have been taught in previous years and that students did not outwardly display any difference in attitude even though they knew they were part of an experiment.

OTHER IMPLICATIONS AND RECOMMENDATIONS

1. Teachers who consider the study of the theoretical aspects of music important for students in performance groups can achieve better results by using material of the type developed during this project. If such materials are used over a period of years, the skills and understanding of students in performance groups concerning the theoretical aspects of music should improve tremendously.

2. A project to prepare materials emphasizing the aspects of music appreciation, literature, and history should be undertaken. These aspects of musical understanding are at least as important, if not more important, than the theoretical aspect. Little concrete help has been given to secondary school teachers to help them present these aspects of music to performance groups.

3. Perhaps the most difficult problem confronting the secondary school teacher who is interested in broadening the musical understandings taught in the performance group is to do this without turning the performance group into a general music class and lowering the standards of performance. Most music educators agree that performance is an extremely important aspect of musical activity. If students are to receive a well-rounded musical education, however, other aspects must also be emphasized. While the quality of performance must not suffer, it may be necessary for many groups to decrease the number of public performances so that more time can be spent on other aspects of music.

CHAPTER 6

SUMMARY

High school music directors have been criticized in recent years for developing programs with emphasis almost entirely on performance to the neglect of teaching general musical understandings and musicianship. The theory of music is one of the aspects of musical understanding upon which directors of high school music groups are being asked to place more emphasis. The main objective of this study was to determine whether or not students in performing groups, using prepared materials, would develop competencies in music theory to a significantly greater extent than students who received only the usual instruction without supplementary materials during the experimental period.

MATERIALS PREPARED

The materials in this project consisted of a programmed textbook, an accompanying album of records, and a teacher's guide. Topics covered in the programmed textbook are as follows:

> Meter, rhythm, tempo, note recognition(treble and bass clef), intervals, scales, key signatures, major and minor scales, modes, musical terms (tempo and dynamic), triads, chord progressions, harmonization of melodies, and timbre of the various orchestral instruments

PILOT STUDY

During the spring of 1966 a pilot study with a small group of college students was conducted using the prepared materials. The students were volunteers from a class in music fundamentals for classroom teachers. None had studied music previously except as participants in high school performance ensembles. The students met with the instructor for twelve 50 minute periods including the periods for the pretest and posttest.

Measurements obtained in analyzing the data of the pilot study in music theory are in Table 6.1.

TABLE 6.1

TABLE OF MEASUREMENTS OBTAINED IN ANALYZING THE DATA OF A PILOT STUDY IN ACHIEVEMENT IN MUSIC THEORY

Variables	Number	Mean	Median	S. D.
Pretest	12	12.9	11	8.34
Posttest	12	52.3	51.5	9.63
Difference scores between pretest and posttest	12	38.7	39.5	4.22
Time in hours	11*	30.9	25.5	10.7
Programmed instruction Frames missed (number out of 1,000)	11*	51.1	43	32.8

*One student did not complete the text.

The results of the pilot study were as follows:

1. The group made a highly significant gain from the pretest to the posttest showing that students can successfully complete a course in basic theory using programmed materials plus a small amount of class time.
2. The time spent on the course showed that the average student completed the course in about 30 hours, not an excessive amount of time for high school students to study outside of class in the planned field study.
3. The number of frames missed suggested that not much revision was necessary before giving the materials to high school students in the field study.

After the pilot study the following steps were taken:

1. Any frame that was missed by 25% or more students in the pilot study was revised so that errors would be less likely. It was also found that certain material near the end of the book proved to be quite difficult so it was omitted from the text to be used in the field study.

2. All of the musical examples were re-recorded using a variety of orchestral instruments.

3. The test was divided into 2 portions. Part A consists entirely of written theory containing questions on rhythmic and pitch notation, key signatures, scales, intervals, chords, musical terms, and harmony. Part B measures the ability to relate musical sounds to notation. This part of the test has questions relating to melodies, intervals, chords, and progressions.

4. A sampling of undergraduate students at Eastern Washington State College was given the test. Those items found to be negatively discriminating were modified to correct for this discrimination.

FIELD STUDY PRETEST

In the fall of 1966 the test described above was given to 957 students in the experimental and control groups. The experimental group consisted of 482 students in 9 secondary schools in eastern and central Washington. The control group consisted of 475 students in 8 high schools. The most important null hypotheses tested were as follows:

1. There is no significant difference between the scores of the experimental and control groups on the pretest.

2. There is no significant relationship between the scores on the pretest and grade level of students.

3. There is no significant relationship between the scores on the pretest and the academic achievement of students as measured by grade point average in all subjects which the student has taken.

4. There is no significant difference between the scores of students having taken 2 years or more of private music study and students not having had 2 years of private music study.

The methods of analysis were: hypothesis 1 was tested by means of the _t_ test, hypothesis 2 was tested by means of chi square, hypothesis 3 was tested by means of Pearson product-moment correlation coefficient, and hypothesis 4 was tested by means of the _t_ test.

Hypothesis 1. Statistical comparison of the experimental and control groups as assessed by a pretest showed no significant difference in the two groups, although the control group showed slight superiority. On Test A a *t* of .3267 was computed. On Test B a *t* of 1.083 was computed. Hypothesis 1 is accepted.

Hypothesis 2. A comparison of the scores and grade level revealed a chi square of 11.956 on Part A of the test and a chi square of 22.279 on Part B. Neither is significant at the .05 level of confidence, showing little relationship between scores and grade level. Hypothesis 2 is accepted.

Hypothesis 3. The relationship between scores made on the test and general academic record as measured by the cumulative grade point average showed an *r* of .484 on Part A of the test and an *r* of .433 on Part B. Since both correlations are highly significant beyond the .01 level of confidence, hypothesis 3 is rejected. Students with higher grade point averages made significantly higher scores.

Hypothesis 4. The difference between scores for students with private study for 2 or more years and students without private study for 2 years was highly significant. In Part A the *t* was 10.546 and in Part B the *t* was 10.617. Since both of these are highly significant beyond the .01 level of confidence, hypothesis 4 is rejected. The students who had studied privately made significantly higher scores.

The experimental and control groups were well matched on the pretest. The slight superiority of the control group was much better than if the experimental group had shown superiority.

The lack of relationship between grade level and scores on the test means that students in the upper grades did not score significantly higher on the test than did the students in the lower grades of the secondary schools.

The students with a high general academic achievement achieved high scores on this music theory test. The students who have had 2 or more years of private study also achieved high on this test. To determine which is the more influential factor, general academic achievement or private music lessons, further research is necessary.

THE POSTTEST COMPARED WITH THE PRETEST

The test which was given as a pretest was given as a posttest in May, 1967. The following are the most important null hypotheses tested:

1. There is no significant difference between the experimental and control groups in amount of improvement in scores of the posttest over the pretest.
2. There is no significant difference between pretest and posttest scores for all students taking these tests.
3. There is no significant difference between pretest and posttest scores for students in the control group.
4. There is no significant difference between pretest and posttest scores for students in the experimental group.
5. There is no significant relationship between the amount of achievement made as assessed by pretest and posttest and grade levels of students.
6. There is no significant difference between the amount of achievement made as assessed by pretest and posttest by students having taken 2 or more years of private music study and students not having had 2 years of private music study.
7. There is no significant relationship between the amount of achievement made as assessed by pretest and posttest and academic achievement of students.
8. There is no significant relationship between the amount of achievement made as assessed by pretest and posttest and the percentage of frames missed in the programmed text.

The methods of analysis were: hypotheses 1 and 6 were tested by means of the t test for independent samples; hypotheses 2, 3, and 4 were tested by means of the t test for paired observation; hypothesis 5 was tested by means of chi square; and hypotheses 7 and 8 were tested by means of the Pearson product-moment correlation coefficient.

The results of the testing were as follows:

Hypothesis 1. In computing the difference between the experimental and control group in amount of improvement in scores of the posttest over the pretest, a t of 10.599 was computed for Test A and a t of 3.134 was computed for Test B. These are highly significant beyond .01 level of confidence. The improvement in scores made by the experimental group was significantly more than the improvement made by students in the control group. Hypothesis 1 is rejected.

Hypothesis 2. Computation of the difference between pretest and posttest scores for all students showed a significant difference between the pretest and posttest. A t of 15.736 was computed for Test A and a t of 6.831 was computed for Test B. These are highly significant beyond the .01 level of confidence. Hypothesis 2 is rejected because the posttest scores were significantly higher than the pretest scores.

Hypothesis 3. For students in the control group, computation of the difference between pretest and posttest gave a t of 7.146 on Test A and a t of 2.626 on Test B. These are highly significant beyond the .01 level of confidence showing that the control group made significant improvement from pretest to posttest. Hypothesis 3 is rejected.

Hypothesis 4. Computing the difference between the pretest and posttest scores for students in the experimental group showed a t of 14.024 on Test A and a t of 6.806 on Test B. These are highly significant beyond .01 level of confidence, showing that the experimental group improved significantly from pretest to posttest.

Hypothesis 5. Computation of the chi square showed that there is no significant relationship between the amount of achievement made as assessed by pretest and posttest and the grade level of students in either the control or experimental groups. For the control group, Test A, $\chi^2=20.473$ and Test B, $\chi^2=18.389$. For the experimental group, Test A, $\chi^2=19.243$ and Test B, $\chi^2=18.260$.

Hypothesis 6. Students in the control group who had taken 2 or more years of private study did not achieve significantly more in either of the tests than did the students who had not taken 2 years of private music study. (Test A, $t=.7964$; Test B, $t=1.570$) However, students in the experimental group who had private study showed significantly more achievement than students who had not had private study. (Test A, $t=2.37$; Test B, $t=2.642$) Hypothesis 6 is accepted for the control group but rejected for the experimental group.

Hypothesis 7. Computation shows no significant relationship between achievement in music theory and general academic achievement for the control group. (On Test A, $r=.060$; on Test B, $r=.033$) There is, however, a significant relationship between the amount of achievement made on the theory test as compared to the general academic achievement by students in the experimental group; those students who had high general academic achievement also made significant achievement in music theory. On Test A, $r=.307$ (significant at .01 level of confidence). On Test B,

$\underline{r}$=.122 (significant at .05 level of confidence). Hypothesis 7 is accepted for the control group but rejected for the experimental group.

Hypothesis 8. Computation of the relationship between achievement in music theory and the percentage of frames missed in the programmed text shows a nonsignificant negative correlation for Test A ($\underline{r}$=-.099) and a relationship significant at the .05 level of confidence for Test B ($\underline{r}$= -.131). The negative correlation indicates that the students with higher scores made the fewer errors in answering the questions in the programmed textbook. Hypothesis 8 is accepted for Test A but rejected for Test B.

The computations showing that the experimental group achieved much more than did the control group shows that the materials furnished to the experimental group were successful in helping students to learn more music theory than did students without these materials in performance groups.

The lack of a significant relationship between the amount of achievement made in music theory as assessed by the pretest and posttest and the grade levels of the students in the experimental group indicates that it does not make much difference at which level in the secondary school these materials are used.

Students in the experimental group who had taken private lessons for 2 years or more achieved significantly more during the time of the theory course than did those who had not taken private lessons for 2 years. One explanation is that those students who are more interested in music are more likely to be taking music lessons.

The better students academically probably achieved more in this course because it involves the academic portion of music. It is also necessary that a student be able to read well in order to study the course by himself. If he cannot read and understand, it is impossible for him to receive much value from self-instructional materials.

The negative correlation between scores and percentage of frames missed is probably brought about for a very similar reason to the one in the preceding paragraph. The student who reads well has very little difficulty in making the correct response to the questions in the frames; the student who does not read well would answer incorrectly because of his inability to read and understand.

TEACHER QUESTIONNAIRE

The following objectives were developed regarding the teacher questionnaires:

1. To obtain an evaluation of the prepared materials by teachers who have used them for a school year.
2. To determine how much student achievement was influenced by amount and kind of class help.
3. To determine reaction to materials by students in experimental groups.
4. To determine whether or not teachers of control groups emphasized music fundamentals and theory more than usual.
5. To determine whether or not there was an observable change in attitude of students in the control groups.

Although the reaction of the teachers to the prepared materials was generally favorable, there were 2 principal criticisms:

1. The material was too difficult in places for most high school students.
2. There was too much material for most students to complete in 1 school year.

In regard to the amount student achievement was influenced by class help, only 4 schools made a highly significant improvement on Test B. Of these 4 schools, the teachers in 3 of them were the only teachers who indicated they spent 30 minutes or more each week on music theory in class. Help in class, then, was an important factor in achievement, particularly on Test B.

According to the teachers, most of the students disliked the course. It seems that the dislike occurred more in the latter part of the book in which the material becomes more difficult. Also, students became tired of week-after-week assignments for the entire school year. The dislike occurred mainly, of course, among those students who had difficulty completing the course for lack of ability or time. The situation would, in part, be alleviated by the following suggestions:

1. The text should be made less difficult and most of the difficult material near the end of the book should be removed.

2. The course could be spread out over a period of 2 years so that students would not become so tired of the weekly assignments.

3. The teacher should take special care to see that the students are motivated. They must be able to see some connection between the theory they are studying and the study of other phases of music, particularly performance.

The teachers of the control group indicated that they did not emphasize music fundamentals and theory more than usual and that there was no observable change in the attitude of students in the control group.

CONCLUSION

Secondary school teachers who consider the study of the theoretical aspects of music important for students in performance groups can achieve significantly better results by using material of the type developed during this project.

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18. Wardian, Jeanne Foster. An Experiment Concerning the Effectiveness of Programmed Learning for Use in Teaching the Fundamentals of Music. Unpublished Doctoral Dissertation. Washington State University, 1963.

APPENDIX A

PROGRAMMED INSTRUCTIONAL MATERIALS IN MUSIC*

Andrews, J. Austin (Eastern Washington State College) and Wardian, Jeanne Foster (Whitworth College). *Introduction to Music Fundamentals*, A Programmed Textbook for the Elementary Classroom Teacher. New York: Appleton-Century-Crofts, 1964. 498 frames plus music. $3.80.

Barnes, Robert A. (Ohio State University). *Fundamentals of Music*, A Program for Self-Instruction. New York: McGraw-Hill Book Company, 1964. 171 pages. Hardcover $5.50. Also available in a paperback edition.

Batcheller, John (University of New Mexico). *Musical Notation*, TEMAC Programmed Learning Materials. Chicago: Encyclopaedia Britannica Press, 1964. 1042 frames. Text and worksheets $3.00, math binder $1.25.

Carlsen, James C. (University of Connecticut). *Melodic Perception*, A Program for Self-Instruction. New York: McGraw-Hill Book Company, 1965. 570 frames. Text $3.95, five 3-3/4 IPS dual track dictation tapes $34.95.

Chakerian, Nan. *Fundamentals of Music*. New York: TMI-Grolier, 1962. $7.50.

Clough, John (Oberlin College). *Scales, Intervals, Keys and Triads*, A Self-Instruction Program. New York: W. W. Norton & Company, 1964. 159 pages. $2.95.

Dallin, Leon (California State College at Long Beach). *Introduction to Music Reading*, A Program for Personal Instruction. Glenview, Illinois: Scott, Foresman and Company, 1966. 142 pages, $3.50.

Harder, Paul (Michigan State University). *Basic Materials in Music Theory*, A Programed Course. Boston: Allyn and Bacon, 1965. 1003 frames. $5.95.

*List as prepared by Dr. Gary Martin of the University of Oregon.

Homme, Lloyd E. and Tosti, Donald T. (both of Teaching Materials Corporation). Fundamentals of Music, Programed Textbook. New York: Teaching Materials Corporation, 1960. 706 frames. $8.50. Also available for use in MIN/MAX machine, $25.00; reusable program, $7.50.

Howard, Bertrand (University of Arkansas). Fundamentals of Music Theory. A Program. New York: Harcourt, Brace & World, Inc., 1966. 164 pages. $3.50.

Martin, Gary M. (University of Oregon). Basic Concepts in Music, Programmed Textbook. Belmont, California: Wadsworth Publishing Company, Inc., 1966. 321 pages. $4.95.

Neal, Winfred. Music Makers. Tempe, Arizona: Learning Inc., 1963. $.15. (3rd grade)

Richards, Mary Helen. Threshold to Music. Palo Alto: Fearon, 1964.

APPENDIX B

SUMMARY OF MUSIC THEORY TEXT

Lesson 1

FRAMES	
1-4	Definition of music
5-15	Definition of theory
16-20	Meter as a factor in rhythm
21-22	Duration as a factor in rhythm
23-24	Tempo as a factor in rhythm
25-33	Simple meters
34-48	Compound meters
49-55	Duration of notes and meaning of bottom number of meter signature
56-61	Simple rhythmic dictation, containing quarter notes, half notes and whole notes

Lesson 2

62-68	Eighth notes added to half, quarter and whole notes
69-73	Simple rhythmic dictation containing eighth, quarter, half and whole notes
74-82	Whole, half, quarter, and eighth rests
83-89	Compound meter signatures
90-94	Same melody written with different meter signatures
95-97	Meaning of C and ¢
98-101	Rules for writing correct rhythmic notation using eighth notes
102-106	Rhythmic dictation

Lesson 3

107-109	Compound meter introducing dotted quarter notes
110-112	Rules and examples for correct notation in compound and simple meters, using eighth notes
113-114	Examples of compound meter for listening
115-119	Rhythmic dictation in $\frac{6}{8}$ meter
120-163	Tempo, terms and metronome markings
164-166	Pick-up notes (anacrusis)
167-171	Rhythmic dictation including pick-up notes

Lesson 4

172-177	Melody, definition
178-182	Pitch, as indicated by the staff
183-187	G clef
188-199	Letter names of notes in treble staff
200-206	Ledger lines, above and below treble staff
207-210	Stems on quarters, eighths, and half notes
211-215	Melodic dictation

Lesson 5

216-231	Names of notes in bass staff
232-236	Ledger lines in bass staff
237-241	Melodic dictation in the bass staff
242-251	The great staff
252-257	Notes on the keyboard
258-265	Octaves on the great staff

Lesson 6

266-270	Whole and half steps on piano keyboard, white keys
271-280	Accidentals on keyboard, including explanation of enharmonic
281-286	Accidentals explained on staff
287-290	Sharps or flats used as key signature
291-301	Major scale, location of half steps
302	Recorded examples of major scales and modes
303-304	Scales for student to indicate as to major or mode
305-309	Major scale on staff
310-322	Major scale numbers and descriptive names

Lesson 7

323-328	F Major scale on staff and keyboard
329-332	G Major scale
333-343	Review C, F, G Major scales with numbers and descriptive names
344-348	Simple melodic dictation
349	Review of scale numbers and descriptive names
350-356	Transposition
357-358	Review C, F, G Major scales and key signatures

Lesson 8

359-368	Finding the key in sharps
369-372	Finding the key in flats
373-381	Order and placement of the sharps on the staff
382-387	Order and placement of the flats on the staff
388	Review frame, order of sharps
389-398	Determining the flats in key signature when the name of the key is given
410-411	Review of C Major and F Major key signatures
412-417	Melodic dictation

Lesson 9

418-433	Major and perfect intervals as contained in major scales
434-442	Intervals using accidentals (major and perfect intervals)
443	Intervals for listening
444-445	Intervals to identify, recorded
446-448	Minor intervals
449	Recorded intervals to identify before answer is given
450-452	Recorded intervals to identify
453-463	Melodic dictation, recorded

Lesson 10

464-477	Triads in root position
478-484	Inversions of triads
485-489	Changing triads from inversions to root position
490-492	The root, 3rd and 5th of triads in root position
493-498	Changing chords from root position to first inversion
499-504	Changing triads from root position to second inversion
505-508	Review of inversions of triads
509	Recorded progressions for listening
510-511	Recorded chordal progressions to identify

Lesson 11

512-517	Dominant 7th chord in root position
518	Recorded examples of chord progressions containing dominant 7th chord for listening
519	Chordal progressions, recorded, to identify
520-529	Melodic dictation with chordal sequence to be indicated

Lesson 12

530	Review
531	Definition of timbre
532-535	Sixteenth notes
536	Slurs
537-543	Recorded examples containing sixteenth notes for listening
544-554	Melodic dictation containing sixteenth notes
555	Directions
556-559	Recorded examples, compound meter, containing sixteenth notes
560-564	Melodic dictation

Lesson 13

565-571	Dotted quarter notes in simple meter
572	Dotted quarter notes in compound meter
573	Ties
574-577	Recorded examples containing dotted quarter notes for listening
578-583	Melodic dictation, dotted halves and quarters
584-585	Dotted eighth notes, simple meter
586-588	Listening, dotted eighths and sixteenths
589-593	Melodic dictation, dotted eighths and sixteenths

Lesson 14

594	Sixteenth rest
595-596	Dotted rests
597-606	Dictation, sixteenth and dotted rests
607-618	Dynamic markings
619-622	Listening, dynamics
623-630	Dictation including dynamics

Lesson 15

631-637	4-part writing; direction of stems
638-643	4-part writing; range of voices
644-648	4-part writing; rules for doubling bass and spacing of tones
649-655	4-part writing; open and closed position
656-658	Chords to be used; tonic, subdominant, dominant
659-670	Basic rules for 4-part writing
671-673	Changing triads to 4-part writing
674-679	4-part writing; recorded for listening after student filled in the parts

Lesson 16

680-683	Syncopation
684-687	Listening; syncopated examples
688-694	Dictation; syncopated examples

Lesson 17

695	Directions
696-699	Listening to new subdivisions of beat
700-704	Dictation; new subdivisions of beat
705-709	Rules for writing rhythmic grouping
710-720	Introducing diminished and augmented intervals
721-723	Listening to various intervals
724-728	Intervals to identify

Lesson 18

729-743	Finding the relative minor from the key signature
744-751	Natural minor scales
752	Recorded examples of major and natural minor scales, for listening
753-754	Identifying scales from the recording; major or natural minor
755-758	Review of writing the major key signature when the name of the key is given
759-766	Finding the key signature when the name of the minor key is given

Lesson 19

767-774	Harmonic minor scales
775	Listening to harmonic minor scales
776-777	Major, natural minor and harmonic minor scales played for identification
778-782	Dictation; melodic

Lesson 20

783-793	Melodic minor scales
794-797	Review of three types of minor scales
798	Listening to examples of three types of minor scales contrasted with major
799-801	Listening to recorded examples of melodies in the three types of minor
802	Scales in the three types of minor to identify
803-812	Melodic dictation

Lesson 21

813-827	Major and minor triads
828	Major and minor triads for listening
829-831	Dictation; major and minor triads
832-838	Diminished and augmented triads
839-841	Triads formed on the steps of a major scale
842-845	Dominant 7th chords
846-847	Triads on harmonic minor scale tones
848-872	Triads--major, minor, diminished and augmented
873	Listening to major, minor, diminished and augmented triads
847-877	Dictation of major, minor, diminished and augmented chords

Lesson 22

878-889	4-part inversions, including Arabic numeral indications
890-892	Review of rules for 4-part writing
893-894	Changing triads to 4-part writing
894-899	Harmony exercises; student is to listen after they are completed

Lesson 23

900-903	Chords built on other scale tones besides I, IV and V; rule for doubling on VII
904-909	Harmony exercises to complete, recorded for listening

Lesson 24

910-927	Doublings other than the root with Arabic numerals under the chord indications to indicate the doublings
928-930	Harmony exercises to complete; recorded for listening

Lesson 25

931-934	Explanation of Arabic numerals to indicate moving part
935-936	Harmony exercises for student to work; recorded for listening

Lesson 26

937-951	Rules for resolving of the dominant 7th and omitting the 5th of the chord
952-955	Harmony exercises practicing resolution of the dominant 7th; recorded for listening

Lesson 27

956-976	Inversions of the dominant 7th chord
977-981	Harmony exercises; recorded for student listening

Lesson 28

982-987	Chromatic alterations
988-992	Harmony exercises for student to complete; recorded for listening

Lesson 29

993-997	Harmony exercises; recorded for listening

Lesson 30

998-1006	Melodic dictation
1007-1011	Melodies for student to harmonize

APPENDIX C

SCHOOLS TAKING PART IN EXPERIMENTAL PROJECT*

School	No. of students	% taking music	Experimental group and size	Control group and size	Comments
A	595	34.9%	Sr. Glee Club (38)	Jr. Glee Club (29)	Private girls' school
B	2136	16.2%	Chorus (52)	Band (97)	Large city H. S.
C	650	26.9%	2nd & 3rd choirs (78)	Band & 1st choir (84)	Suburban H. S. patrons from middle & lower economic group
DX	1400	26.5%	Prep choir (64)		Medium large sized city H. S. patrons from middle & lower economic group
DC	1320	24.8%		Concert choir (79)	Medium large sized city H. S. patrons from middle & upper economic group

*All schools are senior high schools except J which is a junior high school.

E	430	13.3%	Band (43)		Small city H. S.
F	578	33.4%	1st & 2nd bands (66)	Choir (66)	Suburban H. S.
G	810	24.3%	Concert choir (45)	Prep chorus (39)	Suburban H. S.
H	1733	12.2%	Band (68)	Choir (50)	Medium sized city H. S.
J	690	31.0%	Orchestra (28)	Band (30)	Suburban J. H. Outstanding music program starting in 3rd grade

APPENDIX D

STATISTICS ON SCHOOLS

MID-COURSE TEST
(40 Questions)

School	Mean	Median	Standard Deviation
A	22.44	22.0	7.49
B	22.69	20.5	7.32
C	19.27	18.1	6.7
D	16.97	15.0	6.25
E	23.36	23.0	9.0
F	20.29	19.54	6.5
G	20.2	17.3	7.9
H	25.49	26.12	6.5
J	22.57	23.0	6.76

APPENDIX E

STATISTICS ON SCHOOLS

PRETEST

	Test A 50 Questions	Test B 60 Questions	Combined A & B 110 Questions
School A (Control Group)			
RANGE	5-37	11-43	20-70
MEDIAN	14.00	20.00	33.00
MEAN	16.06	20.44	36.51
STD. DEV.	6.67	7.15	12.64
School A (Experimental Group)			
RANGE	5-40	7-47	19-82
MEDIAN	15.00	22.00	36.00
MEAN	16.43	23.69	40.12
STD. DEV.	7.64	8.48	14.65
School B (Control Group)			
RANGE	2-40	8-46	12-80
MEDIAN	13.00	21.00	34.00
MEAN	14.56	22.29	37.13
STD. DEV.	7.63	7.41	13.76
School B (Experimental Group)			
RANGE	2-47	9-52	11-94
MEDIAN	13.50	27.50	41.00
MEAN	16.47	27.62	43.47
STD. DEV.	9.44	9.95	17.53
School C (Control Group)			
RANGE	2-41	9-41	11-82
MEDIAN	14.00	20.00	33.00
MEAN	14.98	20.85	35.84
STD. DEV.	6.57	7.27	12.82

School C (Experimental Group)			
RANGE	4-24	10-34	16-50
MEDIAN	11.00	17.00	29.00
MEAN	11.46	18.31	29.88
STD. DEV.	3.96	5.45	8.28
School D (Control Group)			
RANGE	4-31	8-46	17-64
MEDIAN	13.00	24.00	37.00
MEAN	13.97	23.96	37.91
STD. DEV.	6.00	7.47	12.04
School D (Experimental Group)			
RANGE	1-23	8-37	14-60
MEDIAN	10.00	16.00	26.00
MEAN	10.08	17.22	27.13
STD. DEV.	4.64	6.05	9.16
School E (Experimental Group)			
RANGE	2-25	8-40	20-54
MEDIAN	14.00	21.00	36.00
MEAN	14.46	22.09	36.65
STD. DEV.	4.66	5.64	7.79
School F (Control Group)			
RANGE	4-34	6-43	13-77
MEDIAN	11.00	19.00	30.00
MEAN	12.46	20.25	32.72
STD. DEV.	5.98	8.29	13.42
School F (Experimental Group)			
RANGE	2-44	7-49	15-91
MEDIAN	12.00	18.00	30.00
MEAN	13.25	19.45	32.71
STD. DEV.	7.01	7.85	12.62
School G (Control Group)			
RANGE	3-24	12-38	18-59
MEDIAN	10.00	21.00	32.00
MEAN	10.71	22.28	33.25
STD. DEV.	4.42	6.80	9.92

School G (Experimental Group)			
RANGE	2-41	10-49	16-88
MEDIAN	11.00	22.00	32.00
MEAN	13.93	24.00	37.90
STD. DEV.	9.41	7.92	16.09
School H (Control Group)			
RANGE	6-30	9-42	18-72
MEDIAN	13.00	21.00	34.00
MEAN	14.50	22.46	37.08
STD. DEV.	6.25	7.55	12.70
School H (Experimental Group)			
RANGE	7-34	11-43	19-67
MEDIAN	18.50	22.00	38.50
MEAN	18.51	22.04	40.70
STD. DEV.	6.53	6.46	11.33
School J (Control Group)			
RANGE	7-34	9-36	21-61
MEDIAN	15.00	23.00	36.50
MEAN	15.90	22.30	38.30
STD. DEV.	5.76	6.06	9.99
School J (Experimental Group)			
RANGE	6-28	9-36	20-61
MEDIAN	14.00	23.00	37.00
MEAN	14.82	24.17	39.00
STD. DEV.	5.60	6.78	10.92

APPENDIX F

STATISTICS ON SCHOOLS

POSTTEST

	Test A 50 Questions	Test B 60 Questions	Combined A & B 110 Questions
School A (Control Group)			
RANGE	7-42	7-46	20-73
MEDIAN	17.00	22,00	41.50
MEAN	18.62	23.12	41.75
STD. DEV.	7.83	8.61	14.48
School A (Experimental Group)			
RANGE	4-45	10-52	20-93
MEDIAN	18.00	25.00	41.00
MEAN	20.97	27.41	48.38
STD. DEV.	10.45	10.44	19.85
School B (Control Group)			
RANGE	2-42	9-52	12-83
MEDIAN	17.00	23.00	40.00
MEAN	17.05	24.11	41.17
STD. DEV.	7.63	7.49	13.88
School B (Experimental Group)			
RANGE	7-48	12-58	22-106
MEDIAN	27.00	31.00	56.00
MEAN	26.17	32.69	58.87
STD. DEV.	12.42	11.50	22.76
School C (Control Group)			
RANGE	3-38	8-41	18-79
MEDIAN	15.00	20.50	34.50
MEAN	16.25	22.28	38.62
STD. DEV.	7.18	7.95	14.06

School C (Experimental Group)			
RANGE	5-39	8-37	16-74
MEDIAN	16.00	21.00	36.50
MEAN	17.94	20.68	38.63
STD. DEV.	7.46	6.42	12.30
School D (Control Group)			
RANGE	3-33	8-51	17-84
MEDIAN	14.00	23.00	36.50
MEAN	15.63	23.63	39.26
STD. DEV.	6.42	8.47	13.18
School D (Experimental Group)			
RANGE	6-45	7-47	14-87
MEDIAN	15.00	19.00	35.50
MEAN	18.82	20.40	39.22
STD. DEV.	9.61	8.07	16.10
School E (Experimental Group)			
RANGE	10-41	9-38	20-69
MEDIAN	21.50	22.50	44.50
MEAN	22.07	22.52	44.60
STD. DEV.	7.29	6.75	12.42
School F (Control Group)			
RANGE	8-38	11-49	19-87
MEDIAN	13.00	20.00	35.00
MEAN	16.06	21.59	37.61
STD. DEV.	7.69	8.78	15.32
School F (Experimental Group)			
RANGE	9-43	9-53	20-96
MEDIAN	16.50	20.50	36.00
MEAN	18.24	21.27	39.53
STD. DEV.	7.06	8.29	13.82
School G (Control Group)			
RANGE	5-21	7-34	18-52
MEDIAN	11.00	19.00	30.00
MEAN	12.66	19.86	32.53
STD. DEV.	4.17	7.01	9.94

School G (Experimental Group)			
RANGE	7-42	11-51	24-93
MEDIAN	15.00	22.00	38.50
MEAN	18.12	25.17	44.15
STD. DEV.	9.41	9.12	16.90
School H (Control Group)			
RANGE	7-33	6-48	17-77
MEDIAN	19.00	23.00	39.00
MEAN	17.82	24.37	42.20
STD. DEV.	7.13	9.49	15.06
School H (Experimental Group)			
RANGE	11-39	9-48	24-82
MEDIAN	23.00	22.00	44.00
MEAN	24.00	23.18	47.18
STD. DEV.	7.00	8.07	13.45
School J (Control Group)			
RANGE	11-42	15-39	28-74
MEDIAN	17.50	23.00	39.50
MEAN	18.70	23.86	42.60
STD. DEV.	7.03	6.04	11.08
School J (Experimental Group)			
RANGE	8-36	17-43	28-79
MEDIAN	19.00	27.50	47.00
MEAN	20.32	28.60	48.92
STD. DEV.	7.07	7.86	14.30

APPENDIX G

DIFFERENCE BETWEEN PRETEST AND POSTTEST SCORES BY SCHOOLS

CONTROL GROUP

	Test A 50 Questions	Test B 60 Questions	Combined A & B 110 Questions
School A (n=24)			
PRETEST MEAN	16.21	20.17	36.38
POSTTEST MEAN	18.63	23.13	41.75
t TEST	2.20*	2.38*	2.68*
School B (n=76)			
PRETEST MEAN	15.34	22.83	38.16
POSTTEST MEAN	17.05	24.12	41.17
t TEST	3.00**	2.18*	3.32**
School C (n=66)			
PRETEST MEAN	15.59	21.59	37.23
POSTTEST MEAN	16.26	22.29	38.62
t TEST	1.13	1.04	1.48
School D (n=60)			
PRETEST MEAN	13.75	23.87	37.62
POSTTEST MEAN	15.63	23.63	39.27
t TEST	2.67**	-.28	1.45
School F (n=49)			
PRETEST MEAN	12.73	20.20	32.94
POSTTEST MEAN	16.06	21.59	37.61
t TEST	4.21**	1.64	4.05**
School G (n=15)			
PRETEST MEAN	11.27	23.60	34.87
POSTTEST MEAN	12.67	19.87	32.53
t TEST	.97	-2.02	-1.12
School H (n=35)			
PRETEST MEAN	15.43	23.77	39.49
POSTTEST MEAN	17.83	24.37	42.20
t TEST	2.78**	.61	2.02
School J (n=30)			
PRETEST MEAN	15.90	22.30	38.20
POSTTEST MEAN	18.70	23.87	42.60
t TEST	2.72*	1.79	3.19**

EXPERIMENTAL GROUP

School A (n=34)			
PRETEST MEAN	17.06	24.71	41.76
POSTTEST MEAN	20.97	27.41	48.38
t TEST	3.34**	1.90	2.90**
School B (n=39)			
PRETEST MEAN	17.26	28.77	46.03
POSTTEST MEAN	26.18	32.69	58.87
t TEST	4.68**	3.30**	4.52**
School C (n=58)			
PRETEST MEAN	11.28	18.52	29.79
POSTTEST MEAN	17.95	20.69	38.64
t TEST	5.38**	3.21**	5.47**
School D (n=50)			
PRETEST MEAN	10.64	17.94	28.38
POSTTEST MEAN	18.82	20.40	39.22
t TEST	5.12**	3.07**	5.17**
School E (n=38)			
PRETEST MEAN	14.68	21.89	36.84
POSTTEST MEAN	22.08	22.53	44.61
t TEST	4.81**	.77	4.03**
School F (n=58)			
PRETEST MEAN	13.17	20.19	33.36
POSTTEST MEAN	18.24	21.28	39.53
t TEST	5.60**	1.28	4.83**
School G (n=32)			
PRETEST MEAN	14.72	24.59	39.31
POSTTEST MEAN	18.13	25.72	44.16
t TEST	3.58**	1.52	3.78**
School H (n=53)			
PRETEST MEAN	18.04	21.77	39.81
POSTTEST MEAN	24.00	23.19	47.19
t TEST	5.43**	1.68	4.98**
School J (n=28)			
PRETEST MEAN	14.82	24.18	39.00
POSTTEST MEAN	20.32	28.61	48.93
t TEST	4.00**	3.80**	4.37**

* Significant at .05 level
**Significant at .01 level

APPENDIX H

POSTTEST STATISTICS FOR CONTROL AND EXPERIMENTAL GROUPS WHEN DIVIDED INTO UPPER, MIDDLE, AND LOWER GROUPS OF SCORES

Test A

Upper 25% of Control Group		Upper 25% of Experimental Group	
RANGE	20-42	RANGE	26-48
MEDIAN	25.00	MEDIAN	34.00
MEAN	26.59	MEAN	33.69
STD. DEV.	5.72	STD. DEV.	5.56

Middle 50% of Control Group		Middle 50% of Experimental Group	
RANGE	12-20	RANGE	14-26
MEDIAN	15.00	MEDIAN	18.00
MEAN	15.58	MEAN	18.93
STD. DEV.	2.71	STD. DEV.	3.57

Lower 25% of Control Group		Lower 25% of Experimental Group	
RANGE	2-12	RANGE	4-14
MEDIAN	9.00	MEDIAN	11.00
MEAN	8.93	MEAN	10.87
STD. DEV.	2.34	STD. DEV.	2.25

Test B

Upper 25% of Control Group		Upper 25% of Experimental Group	
RANGE	29-52	RANGE	28-58
MEDIAN	32.50	MEDIAN	35.00
MEAN	34.27	MEAN	36.83
STD. DEV.	5.58	STD. DEV.	7.20

Middle 50% of Control Group		Middle 50% of Experimental Group	
RANGE	17-29	RANGE	18-28
MEDIAN	22.00	MEDIAN	22.00
MEAN	22.49	MEAN	22.54
STD. DEV.	2.96	STD. DEV.	2.78

Lower 25% of Control Group		Lower 25% of Experimental Group	
RANGE	6-17	RANGE	7-18
MEDIAN	15.00	MEDIAN	14.00
MEAN	14.13	MEAN	13.90
STD. DEV.	2.52	STD. DEV.	2.72

Combined A & B

Upper 25% of Control Group		Upper 25% of Experimental Group	
RANGE	47-87	RANGE	54-106
MEDIAN	56.00	MEDIAN	65.00
MEAN	59.27	MEAN	68.61
STD. DEV.	10.28	STD. DEV.	12.28

Middle 50% of Control Group		Middle 50% of Experimental Group	
RANGE	31-46	RANGE	33-53
MEDIAN	38.00	MEDIAN	41.00
MEAN	36.97	MEAN	42.03
STD. DEV.	6.71	STD. DEV.	5.59

Lower 25% of Control Group		Lower 25% of Experimental Group	
RANGE	20-31	RANGE	14-33
MEDIAN	26.00	MEDIAN	28.00
MEAN	26.05	MEAN	27.48
STD. DEV.	2.97	STD. DEV.	4.46

APPENDIX I

POSTTEST STATISTICS FOR EXPERIMENTAL GROUP WHEN DIVIDED ACCORDING TO LESSONS COMPLETED

Test A

LESSONS COMPLETED	25-30	20-24	15-19	0-14
RANGE	7-48	8-43	7-36	4-43
MEDIAN	24.00	22.00	16.50	15.00
MEAN	25.00	22.19	18.29	16.58
STD. DEV.	10.24	8.15	7.59	6.87

Test B

LESSONS COMPLETED	25-30	20-24	15-19	0-14
RANGE	9-58	10-53	7-47	9-44
MEDIAN	26.00	22.00	20.00	21.00
MEAN	28.65	24.19	21.85	20.56
STD. DEV.	10.14	8.26	8.61	7.15

Combined A & B

LESSONS COMPLETED	25-30	20-24	15-19	0-14
RANGE	20-106	22-96	14-83	16-78
MEDIAN	49.50	45.00	37.00	35.00
MEAN	53.75	46.39	40.14	37.16
STD. DEV.	18.74	14.54	14.69	12.10

APPENDIX J

HIGH SCHOOL THEORY SURVEY OF TEACHERS OF EXPERIMENTAL GROUP

School________________

Director______________

1. Average amount of class time spent weekly on theory course:

WEEKLY TIME

_____none
_____15 minutes
_____30 minutes
_____45 minutes
_____60 minutes
_____other

2. Rate your use of the activities suggested for class use in the Teacher's Manual:

_____none
_____very little
_____some
_____quite a bit
_____used most suggestions
_____other

3. Comments concerning Teacher's Manual: (Use extra page if necessary)

4. Rate the reaction of most students to the theory course:

_____disliked intensely
_____disliked
_____no strong feeling either way
_____liked
_____liked very much

Comments concerning student reaction: (Use extra page if necessary)

5. Do you plan to use the course again next year?

_____yes _____no

If you plan to use it with a different procedure, please describe that procedure:

6. An easier and less extensive version will be published this summer. Are you interested in using this revised version even though you would have to purchase it?

_____yes _____no

Comments:

7. Your comments concerning the course:

a) Content

b) Format (arrangement of book, easy or clumsy to handle, etc.)

APPENDIX K

PRETEST MEANS FOR ORIGINAL GROUPS AND FOR THOSE WHO TOOK POSTTEST

Control

Test	Pretest Mean Original 475	Pretest Mean Final 355
A	14.12	14.70
B	21.92	22.31
Combined	36.09	37.05

Experimental

Test	Pretest Mean Original 482	Pretest Mean Final 390
A	13.98	14.37
B	21.38	21.93
Combined	35.45	36.30